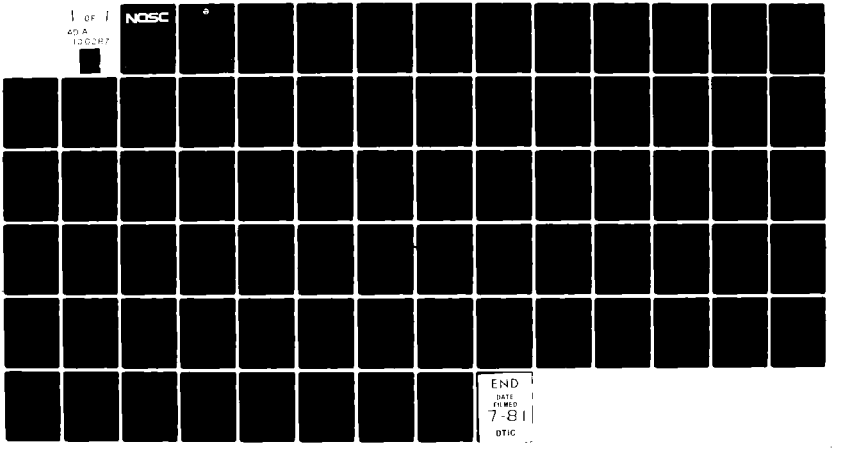
AD-A100 287 NAVAL OCEAN SYSTEMS CENTER SAN DIEGO CA F/G 14/2
TECHNOLOGY ASSESSMENT. 1980 FORECAST OF FUTURE TEST TECHNOLOGY --ETC(U)
MAR 81 V LEONARD, A C MACMURRAY
UNCLASSIFIED NOSC/TD-426 NL

1 OF 1
AD A
100287



END
DATE FILMED
7-81
DTIC

NOSC

NOSC TD 426

NOSC TD 426

Technical Document 426

TECHNOLOGY ASSESSMENT
1980 FORECAST OF FUTURE TEST TECHNOLOGY REQUIREMENTS

V Leonard
AC MacMurray

March 1981

Research Report: February – December 1980

Prepared for
Chief of Naval Material

NAVAL OCEAN SYSTEMS CENTER
SAN DIEGO, CALIFORNIA 92152

NAVAL OCEAN SYSTEMS CENTER, SAN DIEGO, CA 92152

AN ACTIVITY OF THE NAVAL MATERIAL COMMAND

SL GUILLE, CAPT, USN
Commander

HL BLOOD
Technical Director

ADMINISTRATIVE INFORMATION

This technology assessment document has been prepared primarily for the Test Technology Strategy Team, which projects, plans, and implements the US Navy Test Technology RDT&E Plan. Work was performed by the Naval Ocean Systems Center with the assistance of the Centers and Laboratories under the Chief of Naval Material and with the cooperation of the field activities of the systems Commands. The work was conducted with O&MN funding. This document is intended for use by DoD and industry technical personnel performing research and development.

Released by
ME Nunn, Head
Test Technology Office

Under authority of
PC Fletcher, Head
Electronic Engineering and
Sciences Department

ACKNOWLEDGEMENTS

The authors thank the Navy Test Technology Team Strategy Team, all CNM activities, Naval Avionics Center, Naval Air Engineering Center, and Pacific Missile Test Center for their participation during the course of this work. We also gratefully acknowledge the typing assistance of Mabel Bares, NOSC Test Technology Office, in the preparation of this report.

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE *(When Data Entered)*

REPORT DOCUMENTATION PAGE

READ INSTRUCTIONS BEFORE COMPLETING FORM

1. REPORT NUMBER: NOSC Technical Document 426 (TD 426)	2. GOVT ACCESSION NO.: AD-A100287
3. RECIPIENT'S CATALOG NUMBER:	
4. TITLE *(and Subtitle)*: TECHNOLOGY ASSESSMENT 1980 forecast of future test technology requirements	5. TYPE OF REPORT & PERIOD COVERED: Research Report, February - December 1980
6. PERFORMING ORG. REPORT NUMBER:	
7. AUTHOR(s): V. Leonard, AC MacMurray	8. CONTRACT OR GRANT NUMBER(s): NOSC/TD-426
9. PERFORMING ORGANIZATION NAME AND ADDRESS: Naval Ocean Systems Center, San Diego, CA 92152	10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS: O&MN 12175
11. CONTROLLING OFFICE NAME AND ADDRESS: Chief of Naval Material, Washington, DC	12. REPORT DATE: March 1981
	13. NUMBER OF PAGES: 80
14. MONITORING AGENCY NAME & ADDRESS *(if different from Controlling Office)*:	15. SECURITY CLASS. *(of this report)*: Unclassified
	15a. DECLASSIFICATION/DOWNGRADING SCHEDULE:

16. DISTRIBUTION STATEMENT *(of this Report)*

Approved for public release; distribution unlimited

17. DISTRIBUTION STATEMENT *(of the abstract entered in Block 20, if different from Report)*

18. SUPPLEMENTARY NOTES

19. KEY WORDS *(Continue on reverse side if necessary and identify by block number)*

testing	fiber optics
electronics	acoustics
electromagnetic	microwave

20. ABSTRACT *(Continue on reverse side if necessary and identify by block number)*

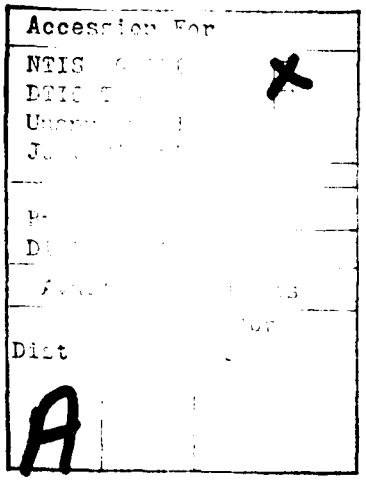
Within the Joint Logistics Commanders Automatic Test Equipment Program, the Navy is assigned the task of monitoring emerging technologies. Monitoring emerging technologies includes assessing and evaluating potential impacts upon future test capabilities. This assessment of research, exploratory development and advanced development categories of research and development was accomplished within the Navy as a pilot project. The next phase will be a tri-service assessment. It is the intent of this document to provide industry and government an overview of potential influences that need to be considered in test technology research and development.

DD FORM 1 JAN 73 1473 EDITION OF 1 NOV 65 IS OBSOLETE
S/N 0102-LF-014-6601

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE *(When Data Entered)*

CONTENTS



I. INTRODUCTION

Technology Assessment is a task identified in the Joint Logistics Commanders (JLC) Panel on Automatic Testing and by the U S Navy "Test Technology RDT&E Plan." The purpose of this task, for the Navy, is to assess developing Navy technologies in order to prognosticate the impact new systems will have on the future of test. This prognosis will support the planning of test technology development and the establishment of priorities.

The task of technology assessment has been divided into five phases:

1. Plan: Analyze alternative approaches to performing the task, scope the task, identify resources and define task constraints.

2. Survey: Conduct a survey of Laboratory Program Summaries at each Navy Lab with the resident Test Technology Strategy Team Member.

3. Consolidate: The survey results from each Lab have been sorted, filtered and consolidated by categories of technology.

4. Analyze: Each technology category was analyzed for possible impact on test technology and summarized in a report for each category.

5. Report: this Test Technology Impact Report will summarize and include as attachments the technology category summaries.

II. PERFORMING TECHNOLOGY ASSESSMENT

The task of conducting a technology assessment to define areas of possible impact on the field of test technology appeared rather straightforward prior to initiation. In the planning phase, in order to scale the task and define the resources required, a pilot assessment was determined to be essential. NOSC was selected as the site for gathering initial technical data from the Laboratory Program Summaries (LPS).

Constraints were decided on to limit the volume of LPSs to be reviewed during the pilot program as follows: (a) All 6.1 tasks, (b) 6.2 tasks funded at $200k or higher and (c) 6.3 and 6.4 tasks funded at $500k or higher. These constraints were based on the assumption that the possibility of a technology reaching the fleet was proportional to the money invested in each funding category.

Results of the NOSC pilot technology assessment:

1. One laboratory did not provide a broad enough data base to assess technology.

2. The technical data gathered would be divided into technology categories for assessment purposes.

3. The gathering of a data base was a technology survey.

4. The 6.4 funding category should be eliminated because first the technology being utilized is not identifiable from the LPS, and second it is about to enter the Fleet.

5. Constraints on 6.1 should increase to $50k and 6.2 and 6.3 should drop to $100k.

6. The technical data gathered via the LPS survey method appeared to be adequate based on the assumption that the data gathered by survey of all the Labs shows trends and details within each technology category.

SURVEY

Based on the NOSC results it was decided to proceed with a survey of all the Navy's technology development efforts. The Test Technology Strategy Team member was contacted at each lab and four important facilities. The intention behind contacting the team members was to gain their participation and their knowledge in support of the survey to be conducted at their activity.

It was soon discovered that each lab is in a different stage of implementing their own peculiar automated data processing system. At a few labs copies of their LPS were readily available and at others not available at all. Schedules were set up to visit those labs with data, and DDC was queried to obtain missing data for the remaining labs.

The Test Technology Strategy Team Members were helpful in surveying each of their lab's technology. The knowledge they possessed facilitated the gathering of useful data. In the future many of the strategists will perform the survey of the technology developments at their labs and send it to NOSC for compiling.

CONSOLIDATE

The data obtained during the technology survey was analyzed to determine what major categories would be appropriate for consolidating data for analysis. Six technology categories were selected. These categories are:

Systems Technology
Component Technology
Transmission Electro-Magnetic Technology
Computer Technology
Electro-Optic Technology
Acoustics Technology

The survey data which was organized by the Navy activity from which it was obtained was regrouped under one or more of these categories. Review of each of these categories revealed that there was sufficient detail for the analysis phase to begin.

ANALYZE

The analysis phase began considerably behind schedule, resulting in a limiting of the depth of the analysis. Interviews with the project personnel had been planned for the more complex technologies, but were terminated for lack of time.

Documenting the analysis turned out to be another problem. After a couple of false starts it was decided that the level of detail required was best displayed in tabular form. The tables identify:

Major Technology Category
Funding Category

Sub Technology Categories
Current Tasks (by title)
Performing Activity
Funds
Potential Test Problems
Test Technology Requirements

Each major technology was briefly summarized. The summary of each technology and the associated tables are included as an appendix to this report.

REPORT

Due to the exploratory nature of this first technology assessment, the process of performing an assessment had to be developed. The report up to this point has described the process of developing technology assessment methods. This approach will be improved during the FY81 Technology Assessment effort as necessary to increase the utility of the product.

III. TECHNOLOGY ASSESSMENT RESULTS

Attached are the summaries and tables to provide the details of the assessment. A brief condensation of the technology forecast contained in these summaries is presented here as an overview.

RDT&E efforts currently being performed for the Navy which appear to need a future test technology development effort or which may result in a useful test application fall into six general categories. These six, in turn, break down into subcategories. The breakdown is as follows:

Systems Technology:

Signal Processing,
Undersea Weapons,
Avionics,
Navigation,
Testing,
Multiplex (Data Transfer),
Architecture,
Machinery,
Missiles.

Components Technology:

Solid State Electronics,
Transducers,
Energy,
Plasma Weapons,
Communications,
Sensors,
Superconductors,
Test Devices,

Transmission Electromagnetic Technology:

RF,
Microwave,
Electronic Warfare,
Antennas.

Computer Technology:

Architecture,
Software.

Electro-Optic Technology:

Fiber Optics,
Infrared,
Ultra Violet,
Lasers,
Optical Devices,
Television.

Acoustics Technology:

Filters,
Transducers,
Signal Processors,
Beam Forming,
Arrays,
Measurement Devices,
Pulse Techniques.

IV. SUMMARY OF IMPACT ON TEST TECHNOLOGY OF FUTURE TECHNOLOGIES

0-5 YEARS (6.4 PROGRAMS)

No data collected.

5-7 YEARS (6.3 PROGRAMS)

In Computer Technology: A period of upgraded hardware technology and increased software complexity will offer the opportunity to gain in systems level testability. Taking advantage of this opportunity will require immediate action to encourage ongoing programs to consider testability in their designs. Microprocessors will allow distributed architecture subsection testing, control, processing, and monitoring. Technology to automatically test and reconfigure large high-density memories must be developed. Software self-test and software standardization are required for large systems.

In Systems Technology: Missile systems will have little or no preflight testing due to safety requirements and limited facility constraints. Therefore Built-In Test (BIT) that is comprehensive enough to monitor all critical parameters is urgently needed for these and future missile systems. Systems with rf transmissions will require end-to-end test, and alignment requirements will press technology into such possibilities as computer-aided interactive techniques.

Target simulation to enable test and alignment in repair facilities will become quite complex to meet the needs of sophisticated new target seekers.

In Electro-Optics Technology: Some programs are being conducted to solve test problems in other areas. These efforts will require calibration technologies.

The complexity of the new technologies being introduced in this time frame necessitates a thorough testability analysis of each. It might be too late to impact design, but the Fleet's upcoming test problems might still be lessened. Only one program has written into its plan that consideration will be given to automatic calibration and test. Another program identifies fault-tolerant design as a goal.

In Transmission Electromagnetic Technology: Major areas of R&D fall into microwave and millimeter wave, radar beamforming and data processing, covert systems, high-speed solid state integrated circuit components, and high-power microwave devices.

The potential test problems are in the area of simulating signal returns to aid in complete system readiness testing and inclusion in the systems and components of built-in test and monitoring capabilities. Components in general have already been designed and produced, making addition of BIT very difficult and DFT impossible.

End-to-end systems tests should be devised, and this would in all probability involve a remote signal simulator comprehensive enough to exercise all the functions of the operational receivers. A test problem is anticipated in monitoring and qualitatively testing the operation of solid state microwave and millimeter wave devices which are being incorporated in new signal processing and in analyzing portions of a variety of potential operational systems. These include high- and low-power active and passive components.

In Acoustics Technology:

An emphasis on active and passive towed or stand-alone sonar systems has created a definite requirement for BIT, perhaps in a form of telemetry BIT. Target simulation will be major problem with testing sonar ranging systems. Acoustic communication and acoustic doppler will present some unique problems for laboratory type tests.

In Components Technology:

Lightweight hydraulics for VSTOL will require test techniques that can predict failure. Solid state power controllers require power BIT technologies.

7-10 YEARS (6.2 PROGRAMS)

Data links between ATE and Logistics can reduce maintenance manpower by automating maintenance data reporting and replacement parts requests. Major systems integration through new computer applications offers possibilities to implement the Operational Readiness Monitoring System (ORMS). Extensive application of distributed microprocessors creates a driving need to enhance subsystem testability through these microprocessors.

In major military systems, voice-stimulated-and-controlled electronics will present some unique test problems, such as range of voice operation measurements. New machinery control and automation concepts will be introduced, and increased emphasis on system interfaces and multiplex buses will require systems level testability and distributed bus BIT. Undersea weapons and missiles are going to require BIT monitoring capability.

Lasers are going to present a formidable test problem in the future. Lasers operating as radars and landing guidance systems will require a test technology similar to that developed for radar systems. The EO systems, IR through television, will use complex image processing and enhancement techniques. Devices such as optical integrated circuits will require a new automated test technology. Real-time processing will exceed our current ATE capabilities. Electro-optics will be employed in roles previously reserved for the human eye and far exceed its capabilities. Test technology will have to produce an assortment of simulators and sophisticated measurement tools, eg, automated image analyzers, to match these systems.

The following new devices and techniques require corresponding test technology developments: broadband hf communications components and systems are being developed for (1) line-of-sight (LOS) covert ship-to-ship communications, (2) spread-spectrum covert communication systems, and (3) battlefield remote enemy detection sensors; microwave and millimeter wave technology such as solid state devices, surveillance systems (both passive and active), target classification systems, communication systems, signal processing, and control methodology.

The major emphasis in the EW area is in signal processing. Test requirements will be to devise reliable low-cost signal synthesizers to simulate EW inputs for on-line system functional testing.

A myriad of components with varied functions, frequencies, power levels, and construction are under development. Examples are SAWs, MW ICs, filters, busses, tuners, amplifiers, high-power tubes/TWTs/magnetrons, switches, transmitters, receivers and signal processors. All of these components and devices should have parallel efforts to include BIT.

The test technologies for sonar must advance to provide the greater accuracy and sensitivity measurement capabilities for these future systems.

Assorted new technology batteries will be entering the Fleet in every application imaginable.

Complex components such as flat panel displays, very-high-speed ICs, systems on a chip, analog/digital ICs, and new chemistry ICs will require considerable emphasis on BIT and testability technologies at the integrated circuit level.

10-15 YEARS (6.1 PROGRAMS)

Real-time signal processors in new weapons systems will require dynamic test capabilities not available today. ATE can not handle most real-time problems today and may require the support of good BIT concepts to do it in this time frame.

More new technologies will be employed in EO systems such as acoustic optics; thus test technology might have to address the problem of simulating the ocean bottom.

Calibration will be a continually growing effort to stay abreast of these technologies.

Electronic components will have achieved several orders of magnitude more complexity per integrated circuit. The system on a chip will be widespread, and single printed circuit boards may house all of the aircraft's electronics.

Highly sensitive solid state detectors will require new stimulus and measurement and calibration capabilities. Tracking accuracies, alignment requirements, and target sensi-

tivities far exceed todays capabilities. The lasers, beam energy, and electromagnetic pulse weapons used with these systems will involve crucial test problems.

In transmission systems, a system to measure communication operation under varying ionospheric conditions could aid system monitoring by predicting comm net operation, and a spread-spectrum TV data link could require spread spectrum signal synthesizers. In electronic warfare, high-power jamming systems are being developed which require safe test and monitoring of the high-power and wideband components.

V. TEST TECHNOLOGY LEVEL OF SUPPORT

The Navy's "Test Technology RDT&E Plan" was created by a joint effort of the Navy and Industry. The objective of the group was to determine the Navy's current and anticipated technology-related test problems and requirements. Research tasks were then defined to develop these test technologies. All of these test technology tasks are described in the Plan in order to provide a Navy-wide coordinated effort.

New tasks are added to the plan as additional requirements for test technology are uncovered. This Technology Assessment was conducted to gauge the impact developing Navy technologies would have on test technology requirements. To do this it is necessary to show the support provided by the planned test technology research for the Navy technologies reviewed in this assessment.

A matrix was developed to compare the test technology requirements of the emerging technologies surveyed by this assessment with test technology development tasks identified in the "Test Technology RDT&E Plan." The technology assessment tasks are listed vertically in the column marked "Current Tasks." The first horizontal row identifies the sections from the RDT&E Plan. The tasks that provide support are listed by code in the vertical column below the section of the plan they come from.

Sections of the Plan are abbreviated to fit in the limited space available. The meaning of the abbreviations are:

ATE SW: Automatic Test Equipment Software
ATPG: Automatic Test Program Generation
DFT: Design for Testability
Mach Test: Machinery Test
New Tech: New Technology
AATC: Advanced Automatic Test Concepts
METCAL: Metrology/Calibration

The code used to identify the test technology task relates to the identification used in the RDT&E Plan:

Funding category (6.1, 6.2, 6.3) or Unfunded (UF) precedes the diagonal. The task number follows the diagonal. Thus a 6.1/1 task in DFT column would be found in Design for Testability Section of the Test Technology Plan as 6.1, task 1; UF/1 would be Proposed task 1. The number in parentheses represents the level of support or impact the test technology task has on the technology listed in the Current Tasks column. The code used for this number is only an estimate of the impact as follows:

(1) Possible impact
(2) Addresses some aspect
(3) Could provide solution
(4) Similar or the same task
(5) Supports test technology

The possible benefit to the Current Tasks from the Test Technology Tasks will come about only if the test technologists cause it to happen.

COMPONENTS TECHNOLOGY

6.1 Technology	Current Tasks	U. S. NAVY TEST TECHNOLOGY RDT&E							
		ATE SW	ATPG	DFT	DFT	Mach. Test.	New Tech.	AATC	METCAL
Solid State	Application Investigation for VHSIC	UF/3(1) UF/4(1)	6.1/1(1) UF/2(3)	6.1/1(1) 6.1/2(1) 6.1/3(1)	6.1/5(2) UF/2(2) UF/4(1)			6.1/1(1) 6.2/6(1) UF/1(5)	
	CCD Correlators for JTIDS Sig. Processing								
	Room Temperature Superconductor in Organic Solids & Biological Systems								
	Applications of Semiconductor Materials						6.2/2(1) 6.2/3(1)		
	Microelectronic Systems	UF/3(1) UF/4(1)		6.1/3(4)			6.2/2(1) UF/1(5)	6.1/2(5) UF/1(5) UF/4(5)	
	Narrow Bandgap MIS Technology								
	Photostructural Properties of Semiconductors								
	Research on Signal Processing Technology								
	Semiconducting Organic Polymers						6.2/2(1)		
	Silicon Field Emission Array Studies							6.2/4(1) UF/2(1)	

Funding Category / Task No (Impact)
or Unfunded

Impact
(1) possible impact
(2) addresses some aspect
(3) could provide solution
(4) similar or same task
(5) supports test technology

COMPONENTS TECHNOLOGY

6.1 Technology	Current Tasks	U. S. NAVY TEST TECHNOLOGY RDT&E							
		ATE SW	ATPG	DFT	DFT	Mach. Test.	New Tech.	AATC	METCAL
Undersea Weapons	Air Deployable Experimental Bathythermograph (AXBT)			6.2/4(1)					
Transducers	Basic Studies of Transduction Materials					All(5)			
Energy	Energy Conversion, Transfer & Storage						UF/2(2)		
	Inductive Energy Storage								
	Electro-Chemical Conversion Devices						UF/2(3)		
Plasma Weapons	Large Beam-Plasma Experiment (SEEBIE)	•							UF/1(1) 6.2/1(1)
	Pulsed Power							UF/2(1)	UF/1(1) 6.2/1(1)
	Pulsed Power Technology							6.2/4(1) UF/2(1)	UF/1(1) 6.2/1(1)
Communications	Neutrino Applications								
Sensors	Space Research Technology								
Superconductors	Superconducting Electronics								

COMPONENTS TECHNOLOGY

6.2 Technology	Current Tasks	U. S. NAVY TEST TECHNOLOGY RDT&E							
		ATE SW	ATPG	DFT	DFT	Mach. Test.	New Tech.	AATC	METCAL
Solid State	Integrated Circuit Technology		UF/2(2)	6.1/2(1) 6.1/4(2)				6.1/2(1) UF/1(5)	
	Compress. An Investigation of "Systems on a Chip"	UF/3(1) UF/4(1)	UF/2(2)	6.1/1(1) 6.1/2(2) 6.1/3(1)	6.1/5(2) UF/2(2) UF/4(1)			6.1/2(1)	
	Hybrid Technology, placing analog and digital circuits on a chip	UF/3(1) UF/4(1)	6.2/1(1) UF/2(2)	6.1/1(1) 6.1/2(1) 6.1/3(1) 6.1/4(1)	6.1/5(2) UF/2(1) UF/4(1)			6.1/1(1) 6.1/2(1) 6.2/3(1)	
	200-A Transcalent Transistor							6.2/3(1)	
	Very High Speed Circuits(VHSIC)	UF/3(1) UF/4(1)	UF/2(3)	6.1/1(1) 6.1/2(1) 6.1/3(1) 6.1/4(1)	6.1/5(2) UF/2(1) UF/4(1)			6.1/2(1)	
	Indium Phosphide Growth and Evaluation								
	High Temperature Electronics								
Undersea Warfare	Underwater Weapons Propulsion & Power Sources								
Test	Oil-in-Water Technology					6.2/5(5)			
Energy	Lithium Batteries for underwater						UF/2(2)		
	Advanced Secondary Batteries						UF/2(2)		
Superconductor	Processing of High TC Superconductors								
Sensor	Magnetic Homing								

COMPONENTS TECHNOLOGY

		U. S. NAVY TEST TECHNOLOGY RDT&E							
6.2 Technology	Current Tasks	ATE SW	ATPG	DFT	DFT	Mach. Test.	New Tech.	AATC	METCAL
Hydraulics	Advanced Development (Cat.6.3) of Lightweight Hydraulic Systems for V/STOL AC					6.2/4(1) 6.2/5(1)			
Solid State	Power Controllers (115 VAC)							6.2/3(1)	

SYSTEMS TECHNOLOGY

6.1 Technology	*Current Tasks*	U. S. NAVY TEST TECHNOLOGY RDT&E						
		ATE SW	ATPG	DFT	Mach. Test.	New Tech.	AATC	METCAL
Navigation	Astro-Geodetic Measurement of Vertical Deflection							UF/7(1)
Undersea Weapons	Autonomous Vehicles	UF/2(1)		6.1/1(1)				
Signal Processing	Low Bit Rate Voice Processing	UF/2(1)		6.1/1(1)				
	Radar Signal Processing	UF/2(1)		6.1/1(1)				
	Multifunction Adaptive	UF/2(1)		6.1/1(1)				

SYSTEMS TECHNOLOGY

6.2 Technology	Current Tasks	U. S. NAVY TEST TECHNOLOGY RDT&E						
		ATE SW	ATPG	DFT	Mach. Test.	New Tech.	AATC	METCAL
Missiles	Close-in/Mid-range Guidance and Control Block Program		6.1/2(1)	UF/1(2)				
	Fire & Forget Anti-Tank Missile Guidance Investigation		6.1/2(1)	UF/1(2)				
Undersea Weapons	Undersea Weapons Guidance & Control Technology	UF/2(1) UF/3(1)	6.1/2(1)	6.2/4(2)				
	Interactive Sonar Operator Project	UF/2(1)	6.1/2(1)	6.2/4(2)				
	Advanced Submarine Command	UF/3(1)	6.1/2(1)	6.2/4(2)				
Machinery	Electrical Power Conversion and Distribution		6.1/2(1)	6.1/4(1)				
	Shipboard Machinery Control Monitoring & Automation	UF/2(1) UF/3(1)			6.2/All(4)		UF/11(2)	
Navigation	Navigation by Automated Image Matching			6.1/1(1)			UF/16(1)	
Multiplex	Compatible Military/ Commercial Aircraft Multi-plex Bus Systems	UF/3(1)	6.1/2(1)	6.1/1(1)				
Combat	Combat System Architecture		6.1/2(1)	6.1/1(1)				
Avionics	Audio Avionics Control Status System						6.2/8(1)	
Test	Aircraft System Test						6.2/8(4)	UF/6(1)
	Testability of Emerging Technologies		6.1/2(5)	Should be in T2 Plan				
	Computer-Aided Test Program Generation		6.2/1(5)					
	Operational Readiness Monitoring System				6.2/All(5)		6.1/3(4) 6.1/4(4) 6.2/6(4)	UF/11(1) 6.2/3(3)
	Overall Combat System Operability (CCSOT)					6.2/All(5)	6.1/3(4) 6.1/4(4) 6.2/6(4)	
	Advance Test Technology	UF/3(4) UF/4(4)		All(1)			6.2/5(4)	6.2/3(5) UF/6(5)

SYSTEMS TECHNOLOGY

		U. S. NAVY TEST TECHNOLOGY RDT&E						
6.3 Technology	Current Tasks	ATE SW	ATPG	DFT	Mach. Test.	New Tech.	AATC	METCAL
Navigation	Navstar Global Positioning System							UF/7(1)
Undersea Weapons	Advanced Lightweight Torpedo	UF/2(1)	6.1/2(1)	6.2/4(2)				
	Adv. Mobile Acoustic Torpedo	UF/2(1)		6.2/4(2)				
	Attack Submarine Communications Center Dev.	UF/2(1)	6.1/2(1)	6.2/4(1)				
	Electric Propulsion			6.2/4(1)				
Sonar	Advanced Surface Sonar	UF/2(1)		6.1/1(1)				
Multiplex	Integrated Shipboard Data Multiplex System	UF/2(1)	6.1/2(1)	6.1/1(1) 6.1/4(1)			6.1/3(1) 6.1/4(1) 6.2/6(2)	
Architecture	Combat System Architecture	UF/2(1)		6.1/1(1) 6.1/4(1) UF/2(1)			6.2/6(2)	
Missiles	Area SAM Technology/ Multimode Guidance	UF/2(1)	6.1/2(1)	UF/1(2)				
	Adv. Intercept Air-to-Air Missile	UF/2(1)	6.1/2(1)	UF/1(2)				
	Adv. Tactical Inertial Guidance System	UF/2(1)	6.1/2(1)	UF/1(2)				
	ASW Standoff Weapon	UF/2(1)	6.1/2(1)	6.2/4(1) UF/1(1)				
Avionics	Missile Site Location System		6.1/2(1)	UF/1(1)				

TRANSMISSION ELECTRO MAGNETIC TECHNOLOGY

		U. S. NAVY TEST TECHNOLOGY RDT&E						
6.1 Technology	Current Tasks	ATE SW	ATPG	DFT	Mach. Test.	New Tech.	AATC	METCAL
Radio Freq	E/M Wavefront Effects of Ionospheric Properties							
	Spread Spectrum TV Data Link		6.1/2(1)	6.1/1(1) 6.1/2(1) 6.1/3(1)				
Microwave	Sea surface remote sensing with HF Radar		6.1/2(1)				UF/2(2)	
Electronic Warfare	Hi Powered Jamming Systems		6.1/2(1)				UF/2(1)	
	Low Frequency High Voltage Communication Jammer		6.1/2(1)				UF/2(1)	
Components	Application Investigation for VHSIC		UF/2(2)	6.1/1(1) 6.1/2(1) 6.1/3(1) 6.1/5(1) UF/4(1)			6.1/2(1)	
	III-IV Compound Semiconductor Microwave						6.2/4(1) UF/2(1)	
	Advanced concepts in Hi Pwr						6.2/4(1) UF/2(1)	
	Millimeter-wave Integrated Ckts		6.1/2(1) UF/2(1)	6.1/3(1) 6.1/5(1)			6.1/2(1) UF/2(1)	6.2/1(1) UF/1(1)
	Monolithic FET Technology			6.1/3(1)			6.1/2(1)	6.2/1(1) UF/1(1)
	M/W Interactions with Semiconductor Devices						6.1/2(1)	
	Near M/W Technology						UF/2(1)	
	Secondary emissions from Oriented Films						6.2/4(2)	
	Microwave Hi Pulsed Power Combiner Research						UF/2(1)	6.2/1(5)
Antennas	Antenna Systems Special						6.2/4(1)	
	Circular Adaptive Arrays						6.2/4(2)	
	H/F Array Control with Reactive Elements						UF/2(1)	
	Microstrip Antennas						UF/2(1)	

TRANSMISSION ELECTRO MAGNETIC TECHNOLOGY

		U. S. NAVY TEST TECHNOLOGY RDT&E						
6.2 Technology	Current Tasks	ATE SW	ATPG	DFT	Mach. Test.	New Tech.	AATC	METCAL
Radio Frequency	Telecommunication Technology							
	Low Probability of Intercept Radio Investigation							
Microwave "M/W"	Solid State Microwave System Support			6.1/1(1) 6.1/3(1) 6.1/5(1)			UF/2(4)	6.2/1(1) UF /1(1)
	RF & M/W System Testability			This Project should be in T2 Plan				UF/1(1)
	USMC Tactical Surveillance						UF/2(1)	
	Advance M/W Subsystems Techniques						UF/2(1)	UF/1(1)
	RF & Microwave Test System		6.1/2(1)				Should be in T2 Plan	6.2/1(1) UF/1(1)
	USMC Command Control Technology		6.1/2(1)				UF/2(1)	
	Church EYE						UF/2(1)	UF/1(1)
Microwave	Elevation Angle Estimation						UF/2(1)	
	Generic Monopulse Model						UF/2(5)	
	Maintenance-Free Radar						Should be in T2 Plan	
	Modulation Techniques for Netter Radars						UF/2(1)	
	MW/MM Wave Controlled Components						UF/2(1)	UF/1(1)
	Radar Systems Research Studies						UF/2(1)	
	Hybrid Tactical Acquisition System						UF/2(1)	
	Radar Ship Profiler						UF/2(1)	

TRANSMISSION ELECTRO MAGNETIC TECHNOLOGY

6.2 Technology	Current Tasks	U. S. NAVY TEST TECHNOLOGY RDT&E						
		ATE SW	ATPG	DFT	Mach. Test.	New Tech.	AATC	METCAL
Microwave Continued	Multi Sensor Ship Classification						UF/2(1)	
	Automatic SAR Ship Classification						UF/2(1)	
Electronic Warfare	ESM Rcvr/Processor Availability						UF/2(1)	
	Dynamic EW Signal Processor							
	Long Pulse Decoy							
Components	Development of Micro-Devices			6.1/3(1)			UF/2(1)	
	Develping 60 Watt IC's			6.1/3(1)			UF/2(1)	
	100 MHz Tunable Bandpass Filters						UF/2(1)	
	200-250 MHz Tunable Bandpass Network on a Chip			6.1/1(1) 6.1/2(1) 6.1/3(1) 6.1/5(1)			UF/2(1)	
	TIES Wideband Signal Distribution System			6.1/4(1)				
	TIES Narrowband Signal Conversion Unit			6.1/4(1)				
	RF Communications Technology						UF/2(1)	
	Microwave Tube Development						6.2/4(2)	
	MMWave Device & Circuit			6.1/3(1)			UF/2(1)	UF/1(1)
	MMWave Communications						UF/2(1)	UF/1(1)
	X Band Solid State Modules		UF/2(2)	6.1/3(1)			UF/2(1)	
	Broadband Cancellor Technology							
	Cathodes for MMWave Power Appl						6.2/4(1)	
	Hi Speed Signal Sorter			6.1/3(1) 6.1/5(1)				

TRANSMISSION ELECTRO MAGNETIC TECHNOLOGY

		U. S. NAVY TEST TECHNOLOGY RDT&E						
6.2 Technology	Current Tasks	ATE SW	ATPG	DFT	Mach. Test.	New Tech.	AATC	METCAL
Components Continued	MW Devices Tech for ECM						UF/2(1)	
	MW Semiconductor Dev. & Circ.		UF/2(2)				UF/2(1)	
	MW Tubes for Radar Applications						6.2/2(2)	
	Solid State Components for ECM		UF/2(2)					
	Ultra Fast Tunable MW Filter						UF/2(1)	
Antennas	Near Field Antenna Measurement						6.2/7(4)	UF/1(1)

TRANSMISSION ELECTRO MAGNETIC TECHNOLOGY

6.3 Technology	Current Tasks	U. S. NAVY TEST TECHNOLOGY RDT&E						
		ATE SW	ATPG	DFT	Mach. Test.	New Tech.	AATC	METCAL
Radio Frequency	HF Improvement Program						6.2/1(1)	
	AJ Techniques Adaptive Antennas Modems						6.2/1(1)	
	EM Source Elimination (ERASE)						6.2/1(1)	
Microwave	Warning Rcvr MMWave Modification						6.2(1) UF/2(1)	
	MW EW Rcvr Des						6.2/2(1) UF/2(1)	
	Area Sam Technology Multi Mode Guidance			UF/1(2)			UF/2(1)	
	MICRAD ASM Guidance			UF/1(2)			UF/2(1)	UF/1(1)
Electronic Warfare	None							
Components	(ERASE) Electro-magnetic Radiating Source Elimination						6.2/2(1) UF/2(1)	
	Coherent Cyclotron Radiation						UF/2(1)	
	NAVSTAR GPS Tech Development						UF/2(1)	
	Passive Components Broadband						UF/2(1)	
Antennas	None							

COMPUTER TECHNOLOGY

		U. S. NAVY TEST TECHNOLOGY RDT&E							
6.1 Technology	Current Tasks	ATE SW	ATPG	DFT	DFT	Mach. Test.	New Tech.	AATC	METCAL
Architecture	Architecture Tuning of Signal Sorters	UF/2(1) UF/3(1)		6.1/1(1)					
Software	Development of Advanced Airborne Executive Program	UF/2(1)	6.1/2(1)						
6.2 Technology	Current Tasks	ATE SW	ATPG	DFT	DFT	Mach. Test.	New Tech.	AATC	METCAL
Architecture	Navy Logistics Distributed Terminal Processing	UF/2(1)		6.1/1(1) 6.1/2(1) 6.1/3(1)	6.1/4(1) UF/2(1) UF/4(1)			All 5	
	Shipboard Material Control, Distribution & Storage	UF/2(1)						All 5	
	Combat Direction System Processing	UF/2(1)		6.1/1(1)				6.2/6(2)	
	Air Weapons Microproc. (microprocessor applications to airborne weapon systems)	UF/2(1)	6.1/2(1)	6.1/1(1) 6.1/4(1) UF/4(1)				UF/1(2) UF/4(2)	
Software	Shipboard Logistics Processing System	UF/1(1)						All 5	
6.3 Technology	Current Tasks	ATE SW	ATPG	DFT	DFT	Mach. Test.	New Tech.	AATC	METCAL
Architecture	AN/USQ-20B Emulation	UF/1(1) UF/2(1)						UF/1(1) UF/4(1)	

ELECTRO OPTICS TECHNOLOGY

6.1 Technology	Current Tasks	U. S. NAVY TEST TECHNOLOGY RDT&E						
		ATE SW	ATPG	DFT	Mach. Test.	New Tech.	AATC	METCAL
Fiber Optics (FO)	Infrared Detectors					6.2/2(1)		6.3P2(1)
	Fiber Optic Sonar System					6.2/2(2)		6.3P2(1)
	Clearday Ultra low loss Fiber Optics					6.2/2(3)		6.3P2(1)
	Dev. F.O. Techniques for					6.2/2(2)		6.3P2 (2)
Lasers	Solid State Lasers for					UF/1(2)		UF/10(1)
	Rare Earth Vapor Phase Lasers					UF/1(1)		UF/10(1)
	Chemical & Molecular Lasers					UF/1(1)		UF/10(1)
	Electrically Excited Lasers					UF/1(1)		UF/10(1)
	Explosive Lasers					UF/1(1)		UF/10(1)
Infrared IR	Special Optical Sensor Mtrls & Dev.	6.1/2(1)				6.2/3(2) UF/4(1)		6.3P2(1) UF/7(1)
Optical Devices	Acousto-Optics Navy Materials Supt.	6.1/2(1)				UF/4(1)		UF/7(1)
	Image Processing	6.1/2(1)	6.1/1(1)			UF/4(5)		
	Optical Diagnostics					6.2/3(5) UF/4(5)		6.3P2(1) UF/7(1)
	Optical Microcircuitry	6.1/2(1) UF/2(1)	6.1/1(1) 6.1/3(1)			6.2/3(1)		6.3P2(1) UF/7(1)
	Optical Processing Techniques	6.1/2(1)	6.1/1(1)			6.2/3(5)		UF/7(1)
	Visible, IR, E-O Devices		UF/1(1)			6.2/3(1) UF/4(1)		6.3P2(1) UF/7(1)
Ultraviolet (U.V.)	Far U.V. Environment & Sensor Dev.							
	Satellite U.V. Imaging Sensor							
Television	Image Processing (See Optical Dev.							

ELECTRO OPTICS TECHNOLOGY

		U. S. NAVY TEST TECHNOLOGY RDT&E						
6.2 Technology	Current Tasks	ATE SW	ATPG	DFT	Mach. Test.	New Tech.	AATC	METCAL
Fiber Optics (FO)	FO Test Capability for ATE					6.2/2(5)		6.3P2(2)
	FO Technology			6.1/3(1)		6.2/2(2)		6.3P2(1)
	Optical Cables for Towed Arrays					6.2/2(2)		
Lasers	Blue-Green Laser Development					6.2/3(3) UF/1(3)		UF/10(1)
	Electronic State Lasers					6.2/3(1)		UF/10(1)
	Free Electron Lasers					6.2/3(1)		UF/10(1)
	Pulsed Chemical Laser Tech					6.2/3(1)		UF/10(1)
	Photo Initiated DF Laser					6.2/3(1)		UF/10(1)
	Adv. Hypersonic Wedge Nozzle Tech.					6.2/3(1)		UF/10(1)
	Laser Radar Technology					6.2/3(2) UF/1(2)		UF/10(1)
	Expendable Laser Illuminator					6.2/3(2)		UF/10(1)
Infrared (IR)	USMC Tactical Surveillance			6.1/4(1)		6.2/3(2)		6.3P2(1)
	Clutter Rejection for IR Array					6.2/3(1)		6.3P2(1)
	IR Focal Plane Array Sensors			6.1/1(1) 6.1/4(1)		6.2/3(1)		6.3P2(1)
	Strike Applications of FLIR			6.1/4(1)		6.2/3(1)		6.3P2(1)
	Multi-Sensor Ship Classification			6.1/1(1) 6.1/4(1)		6.2/3(1)		
	Concealed Origin Optical Locating System			6.1/4(1)		6.2/3(1)		UF/10(1) 6.3P2(1)
	Laser Augmented Air Rescue Sys			6.1/4(1)		6.2/3(2)		UF/10(1) 6.3P2(1)
Optical Devices	Optical Hydrophone					6.2/3(1)		UF/7(1)
	Electro Optic Technology		6.1/2(1)			6.2/3(2)		UF/7(1)
	EO Weaponry		6.1/2(1)			6.2/3(2)		UF/7(1)
	Acoustic-Optical Tech.Adv.		6.1/2(1)			6.2/3(1)		UF/7(1)
	Single Mode Optical Tech.					6.2/3(1)		UF/7(1)
Ultraviolet(UV)	USMC Command Control Tech.							
Television	None							

ELECTRO OPTICS TECHNOLOGY

6.3 Technology	Current Tasks	U. S. NAVY TEST TECHNOLOGY RDT&E						
		ATE SW	ATPG	DFT	Mach. Test.	New Tech.	AATC	METCAL
Fiber Optics (FO)	Bearing Performance Monitoring				6.2/4(5)			6.3P2(2)
	Avioptics			6.1/4(1)		6.2/2(3)		6.3P2(1)
	Unified Single Fiber MT Prog.					6.2/2(2)		6.3P2(1)
Lasers	Develop Ring Laser Gyros			UF/1(1)				
Infrared (IR)	Adv. IR Scanners & Display		6.1/2(1)			6.2/3(2)		6.3P2(1)
	IR Attack Weapon		6.1/2(1)	UF/1(2)		6.2/3(3) UF/4(2)		6.3P2(1)
Optical Devices	Image Processing			6.1/4(1)				
	Adv. Unmanned Search System					6.2/3(1)		
Ultraviolet	None							
Television	Digital Zoom TV			6.1/4(1)				
	Area SAM Tech/Multimode			UF/1(2)				

ACOUSTIC TECHNOLOGY

		U. S. NAVY TEST TECHNOLOGY RDT&E						
6.1 Technology	Current Tasks	ATE SW	ATPG	DFT	Mach. Test.	New Tech.	AATC	METCAL
	Low Power Adv. Acoustic Signal Processor							
	Advanced Transducer & Radiation Concepts							
	Transducer Application of New Ceramic Materials							

ACOUSTIC TECHNOLOGY

6.2 Technology	Current Tasks	U. S. NAVY TEST TECHNOLOGY RDT&E						
		ATE SW	ATPG	DFT	Mach. Test.	New Tech.	AATC	METCAL
	High Definition Sonar Technology		6.1/2(1)	6.1/1(1) 6.1/4(1)				
	Evaluate CCDs for Hi Resolution Sonar Beam Forming							
	Transduction Sciences		6.1/2(1)					
	USMC Tactical Surveillance			6.1/4(1)				
	Large and Wide Aperture Array							
	Sonar Standards and Measurement Techniques							
	Advanced Autonomous Array							
	Sensor Design for Undersea Surveillance							
	Parametric Sonar Echo Ranging Systems							
	Acoustic Transient/Intercept Development							

ACOUSTIC TECHNOLOGY

6.3 Technology	Current Tasks	U. S. NAVY TEST TECHNOLOGY RDT&E						
		ATE SW	ATPG	DFT	Mach. Test.	New Tech.	AATC	METCAL
	ASW Rapidly Deployable			6.1/1(1)				
	Shipborne Minehunting Sonar							
	Pressure/Acoustic/Magnetic Minesweeping System							
	Doppler/Pulse Sonar System							
	Adaptive Line Canceller & Enhancer							
	Advanced Unmanned Search System			6.1/1(1)				
	Acoustic Communication Sea Test							
	RAPLOC/WAA System							
	Submarine Active Detection Sonar							
	RAPLOC Low Impact Dev. Program							
	Sonar Development for Adv. P1							
	Advanced Surface Sonar Program							

TECHNOLOGY ASSESSMENT APPENDIX

A. Systems Technology
B. Component Technology
C. Transmission Electromagnetic Technology
D. Computer Technology
E. Electro-Optic Technology
F. Acoustic Technology

A, SYSTEMS TECHNOLOGY

Systems is a broad category covering many technologies. The major area of application or major technology employed was used to break out and group the systems. These groups are:

Navigation	Machinery
Undersea Weapons	Test
Signal Processing	Multiplex
Avionics	Architecture

Summary of impact on Test Technology:

5-7 YEARS

Missile systems will have little or no preflight testing due to safety requirements and limited-facility constraints. Built-in tests (BIT) that are comprehensive enough to monitor all critical parameters are urgently needed for these and future missile systems.

Alignment requirements will press technology into such possibilities as computer-aided interactive techniques.

Several programs offer opportunities for test technology program integration particularly for ORMS.

Target simulation to enable test and alignment in repair facility will become quite complex to meet the needs of sophisticated new target seekers.

7-10 YEARS

Several systems-level Test Technology Programs will be maturing in this time frame.

Voice-stimulated-and-controlled electronics will present some unique test problems, such as range of voice operation measurements.

New machinery control and automation concepts will be introduced, which puts a definite requirement on machinery test technology.

Increased emphasis on system interfaces and multiplex busses will require systems-level testability and distributed-bus BIT.

Both undersea weapons and missiles are going to require BIT monitoring capability.

10-15 YEARS

Real-time signal processing will be the heart of most systems. ATE can not handle most real-time problems today and may require the support of good BIT concepts to do it in this time frame.

SYSTEMS TECHNOLOGY

6.1 Technology	Current Tasks	Activity	Funds $1000 units	Potential Test Problems	Test Technology Requirement
Navigation	Astro-Geodetic Measurement of Vertical Deflection	NADC	90	Combines complex measurements	Alignment and Calibration
Undersea Weapons	Autonomous Vehicles	NRL	185	Unmanned free swimming submersible	BIT and Fault Tolerance
Signal Processing	Low-Bit-Rate Voice Processing	NRL	105	Different voice quality measurement	New audio test technology
	Radar Signal Processing	NRL	125	Automatic target detection in noise/clutter environment	Simulating targets in noise/clutter environments and calibration
	Multifunction Adaptive Processing Rays	NSWC	300	Real time signal processing	Target simulation & real time testing

SYSTEMS TECHNOLOGY

6.2 Technology	Current Tasks	Activity	Funds $1000 units	Potential Test Problems	Test Technology Requirement
Missiles	Close-in/Mid-Range Guidance and Control Block Program	NSWC	1,505	Limited preflight testing	Missile testability & fault tolerance
	Fire & Forget Anti-Tank Missile Guidance Investigation	NWC	450	Highly compact electronics	BIT
Undersea Weapons	Undersea Weapons Guidance & Control Technology	NUSC	449	Limited space for ATE	BIT
	Interactive Sonar Operator Project	NUSC	585	Highly automated system	BIT & self-testing software
	Advanced Submarine Command	NUSC	213	Limited space	BIT & self-testing software
Machinery	Electrical Power Conversion and Distribution	NSRDC	440	Needs testability inputs soon	Power distribution BIT
	Shipboard Machinery Control Monitoring & Automation	NSRDC	311	Time to implement performance monitoring	Machinery performance monitoring
Navigation	Navigation by Automated Image Matching	NAC	Unknown	Testing of image match functions	Simulation & Calibration
Multiplex	Compatible Military/ Commercial Aircraft Multiplex Bus Systems	NADC	110	Multiplex data bus testing	Distributed BIT Bus Tester
Combat	Combat System Architecture	NSWC	3,150	New architecture & interfaces	Design for testability

SYSTEMS TECHNOLOGY

6.2 Technology	Current Tasks	Activity	Funds $1000 units	Potential Test Problems	Test Technology Requirement
Avionics	Audio Avionics Control Status system	NADC	130	Wide range of voice tones and command to test	Voice simulation and automation
Test	Aircraft System Test	NAEC	60	None	Develops aircraft readiness test concepts
	Testability of Emerging Technologies	NAEC	40	None	Design for testability effort
	Computer-Aided Test Program Generation	NAEC	100	None	Improves ATE
	Operational Readiness Monitoring System	NOSC	1053	None	Integrated ships test
	Overall Combat system Operability (OCSOT)	NOSC	1006	None	Developing OCSOT support system
	Advance test Technology	NOSC	402	None	Improve shipboard test and calibration

6.3 Technology	Current Tasks	Activity	Funds $1000 units	Potential Test Problems	Test Technology Requirement
Navigation	Navstar Global Positioning System	NADC	3,160	Alignment	Computerized alignment & calibration
Undersea Weapons	Advanced Lightweight Torpedo	NOSC	6,500	Comprehensive testing	BIT & Fault Tolerance
	Adv. Mobile Acoustic Torpedo	NUSC	14,454	Acoustic tracker test & alignment	Acoustic target simul. & calib.
	Attack Submarine Communications Center Development	NOSC	2,060	Limited space	Comprehensive BIT
	Electric Propulsion	NUSC	245	New technology motors	Mechanical test technology
Sonar	Advanced Surface Sonar	NUSC	3,490	Computer-aided detection & classification	Target simulation
Multiplex	*Integrated Shipboard Data* Multiplex System	NOSC	1,445	Multiplex bus fault isolation	ORMS integration & testability
Architecture	Combat System Architecture	NSWC NOSC NRL	3,150	Testability integration	Testability architecture
Missiles	Area SAM Technology/ Multimode Guidance	NWC	700	No shipboard test	Comprehensive in-flight self-test
	Adv. Intercept Air-to-Air Missile	NWC	1,793	No shipboard test	Comprehensive in-flight self-test
	Adv. Tactical Inertial Guidance System	NWC	209	No shipboard test	Comprehensive in-flight self-test
	ASW Standoff Weapon	NWC	600	No shipboard test	Comprehensive in-flight self-test
Avionics	Missile Site Location System	NWC	590	Alignment & broad aircraft type applications	Must be able to self-test independently and aligned on assorted aircraft.

B, COMPONENT TECHNOLOGY

Component technology involves most major technologies. This category was selected because the broad range of applicability of most components would cause a lot of duplication if identified in each technology.

Summary of impact on test technology:

5-7 YEARS

Most of the components for this time frame have become part of systems in development and are not visible to this level of investigation. Lightweight hydraulics for VSTOL will require test techniques that can predict failure. Solid state power controllers require power BIT technologies.

7-10 YEARS

Assorted new technology batteries will be entering the Fleet in every application imaginable. A broad range of battery test technologies will be required for safe, accurate and adequate Fleet support.

Complex components such as flat panel displays, very high speed ICs, systems on a chip, analog/digital ICs and new chemistry ICs will require considerable emphasis on BIT and testability technologies at the integrated circuit level.

High-temperature and high-current components will operate in hostile environments. BIT technology that can function reliably in these environments is essential if the operational performance is to be monitored.

Machinery test technology will be helped by oil-in-water technology and challenged by new propulsion technologies.

10-15 YEARS

Electronic components will have achieved a couple orders of magnitude greater complexity per integrated circuit. The system on a chip will be widespread, and single printed circuit boards may house all of the aircraft's electronics. Creative test technologies will be essential to the viability of this concept.

Highly sensitive solid state detectors will require new stimulus, measurement, and calibration capabilities. Tracking accuracies, alignment requirements, and target sensitivities, such as would be required to track and destroy small high-speed missiles, far exceed todays capabilities. The lasers, beam energy, and electromagnetic pulse weapons used with these systems will involve test problems that are not even envisioned today.

COMPONENTS TECHNOLOGY

6.1 Technology	Current Tasks	Activity	Funds $1000 units	Potential Test Problems	Test Technology Requirement
Solid State	Application Investigation for VHSIC	NADC	93	Complex systems on a chip	Testability, particularly BIT
	CCD Correlators for JTIDS Sig. Processing	NADC	76	Charge coupled devices	CCD test technology
	Room-Temperature Superconductor in Organic Solids & Biological Systems	NADC	87	High-current machinery	Superconductor Test Technology
	Applications of Semiconductor Materials	NRL	116	Solid state microwave & IR detectors	New test technology
	Microelectronic Systems	NRL	189	Evaluates related diagnostics	Provides BIT & testability concepts
	Narrow-Bandgap MIS Technology	NRL	236	New technology for miniature integrated circuits on film	Test technology for film electronics
	Photostructural Properties of Semiconductors	NRL	118	Devices that change function under optical stimuli	Depends on possible applications
	Research on Signal Processing Technology	NRL	125	Surface acoustic waves and Josephson Junctions device technology	Develop test technology
	Semiconducting Organic Polymers	NRL	60	Photo-conductive and semiconductive integration in organic films	Opto-electrical interaction
	Silicon Field Emission Array Studies	NRL	164	Solid State Arrays	Matrix BIT technology
Undersea Weapons	Air-Deployable Experimental Bathythermograph (AXBT)	NADC	55	Stand-alone device	BIT
Transducers	Basic Studies of Transduction Materials	NRL	117	New technology transducers	Matching test technology

COMPONENTS TECHNOLOGY

6.1 Technology	Current Tasks	Activity	Funds $1000 units	Potential Test Problems	Test Technology Requirement
Energy	Energy Conversion, Transfer & Storage	NRL	255	New energy storage technologies	Storage test technologies
	Inductive Energy Storage	NRL	356	Energy levels dangerous to test	BIT testability
	Electro-Chemical Conversion Devices	NWC	116	Thermal batteries	Develop test technology for shot batteries
Plasma Weapons	Large Beam-Plasma Experiment (SEEBIE)	NRL	418	On-site tests of large units	Testability, portable high energy standards
	Pulsed Power	NRL	386	Megagauss magnetic pulses	Magnetic field measurement and calibration in megagauss range
	Pulsed Power Technology	NSWC	1,500	MHD Generator	Megawatt power tests
Communications	Neutrino Applications	NRL	65	Exotic new technologies	Totally new test technology area
Sensors	Space Research Technology	NRL	186	Application of invisible surveillance sensors	Testability
Superconductors	Superconducting Electronics	NRL	260	Superior performance electronics	Superconductor test technology

COMPONENTS TECHNOLOGY

6.2 Technology	Current Tasks	Activity	Funds $1000 units	Potential Test Problems	Test Technology Requirement
Solid State	Integrated Circuit Technology	NOSC	962	Increased Navy's IC application	IC testability
	Compress. An Investigation of "Systems on a Chip"	NAC		Entire systems on a single integrated circuit	The test system must be included on same chip
	Hybrid Technology, placing analog and digital circuits on a chip	NAC		Analog/digital ICs	Hybrid BIT
	200 Amp Transcalent Transistor	NADC	1,000	Large current measurements	Power and current BIT
	Very High Speed Integrated Circuits (VHSIC)	NADC NOSC NRL	250 600 100	High speed, microminiature, volatile, and complex	BIT on a chip
	Indium Phosphide Growth and Evaluation	NOSC	230	New solid state technology	Test technology development
	High-Temperature Electronics	NRL	100	Jet engine environment solid state control devices	Engine circuits testability
Undersea Weapons	Underwater Weapons Propulsion & Power Sources	NUSC	2,300	New propulsion technology	Machinery test technology
Test	Oil-in-Water Technology	NRL	120	A test technology	Utilize in machinery test technology
Energy	Lithium Batteries for underwater	NOSC	250	Explosive under test conditions	Battery test technology
	Advanced Secondary Batteries	NUSC	371	Sophisticated new battery technology	Battery test technology
Superconductor	Processing of High TC Superconductors	NRL	200	Superconducting data busses	Superconducting BIT and Testability
Sensor	Magnetic Homing	NCSL	200	Simulating target magnetic fields	Simulation, Test & Calibration

COMPONENTS TECHNOLOGY

6.3 Technology	Current Tasks	Activity	Funds $1000 units	Potential Test Problems	Test Technology Requirement
Hydraulics	Advanced Development (Cat.6.3) of Lightweight Hydraulic Systems for V/STOL AC	NADC	1,603	Hydraulic system fatigue	Test techniques appropriate for lightweight hydraulics
Solid State	Power Controllers (115 VAC)	NADC	223	Solid state power control	BIT power tests

C, TRANSMISSION ELECTROMAGNETIC TECHNOLOGY

Transmission Electromagnetic Technology development is a broad-based area covering the expanding frequency spectrum of systems which transmit and receive signals. The systems under development have been categorized under the headings of Radio Frequency, Microwave, Electronic Warfare, Antennas, and components. Systems range from the stated electronic warfare, through radar, communication, signal detection, command control nets, target classification, and the antennas and components development for these systems. Major areas of R&D fall into microwave (MW) and millimeter meter wave (MMW), radar beamforming and data processing, covert systems, high-speed solid state integrated circuit components, and high-power microwave devices.

5-7 YEARS - 6.3 TASKS

o Radio Frequency: R&D tasks include high-frequency (HF) broad-based improvements for task force communications, anti-jam communication systems, and HF source detection systems. The potential test problems are in the areas of simulating signal returns to aid in complete system readiness testing and including built-in test and monitoring capabilities.

o Microwave: The major tasks involve development of receivers which are broadband and detect and analyze received signals, (EW, warning, and signal location receivers). The receivers and systems employing same are in the latter stages of development, so an end-to-end systems test should be devised. This would, in all probability, involve a remote signal simulator comprehensive enough to exercise all the functions of the operational receivers.

o EW: There are no EW tasks in the 6.3 area with major T^2 implications other than the problems described in MW above.

o Components: A test problem is anticipated in monitoring and qualitatively testing the operation of solid state MW and MMW devices which are being incorporated into new signal processing and analyzing portions of a variety of potential operational systems. These include high- and low-power active and passive components. Another concern for T^2 is the requirement to monitor remote operational cesium time standards.

o Antennas: There are no near-term antenna T^2 problems.

7-10 YEARS - 6.2 TECHNOLOGY

o Radio Frequency (RF): A number of broadband "state of the art" HF communications components and systems are being developed for line-of-sight (LOS) covert ship-to-ship communications. Another area of concern is spread-spectrum covert communication systems and battlefield remote enemy detection sensors. Monitoring operation of the sensors and the net under operational conditions poses a difficult and unique test problem.

o Microwave: Microwave and millimeter wave technology has many varied 6.2 develoment projects. Subsets of MW projects could be solid state devices, surveillance systems, both passive and active, target classification systems, communication systems, signal processing and control methodology, and both system and component test and reliability improvement technology. Major test problems to a great extent depend on results of the projects. Some apparent problems will be incorporation of BIT for operational monitoring and failure detection of systems and components, simulation of signals to be processed in systems for purposes of end-to-end test, and methods to determine proper operation of broadband covert communication systems.

o Electronic Warfare (EW): Major emphasis in the EW area is in signal processing. Test requirements will be to devise reliable low-cost signal synthesizers to simulate EW inputs for on line system functional testing.

o Components: A myriad of components with varied functions, frequencies, power levels, and construction are under development. Examples are SAWs, MW ICs, filters, busses, tuners, amplifiers, high power tubes/TWTs/magnetrons, switches, transmitters, receivers and signal processors. All of these components and devices should have parallel efforts to include BIT.

o Antennas: There is only one 6.2 antenna project, and it directly benefits end-to-end on-line system test of transmitting or receiving systems by developing near-field antenna sensitivity and pattern tests in the field.

10-15 YEARS (6.1) TECHNOLOGY

o Radio Frequency (RF): There are two 6.1 tasks in RF. One task develops a system to measure communication operation under varying ionospheric conditions, which could aid system monitoring by predicting comm net operation. The second project is a spread-spectrum TV Data Link, which could require spread-spectrum signal synthesizers as well as the failure-detection and component-monitoring BIT.

o Microwave: One task only, and it is a sea surface condition sensor using radar. Only known requirement would be signal synthesizer to stimulate the system for calibration and test.

o Electronic Warfare: Techniques for high-power jamming systems are being developed. Test requirements are safe test and monitoring of the high-power and wide band components.

o Components: VHSIC, new solid state devices MMW devices, optical devices, and high-power components will be made available from the 6.1 projects currently funded. As the research is transitioning into 6.2 work, the test methodology requirements must be determined and funded as part of each 6.2 effort.

o Antennas: There are several low-cost efforts underway, but it is premature to predict test problems and solutions.

TRANSMISSION ELECTROMAGNETIC TECHNOLOGY

6.1 Technology	Current Tasks	Activity	Funds $1000 units	Potential Test Problems	Test Technology Requirement
Radio Freq	E/M Wavefront Effects of Ionospheric Properties	NRL	180	Measurement of wideband (1) output from antenna, end-to-end performance testing of operational sys.	Task could aid performance measures by predicting communication circuit characteristics under various ionospheric conditions.
	Spread-Spectrum TV Data Link	NAC	Unk	Measurement of link performance characteristics with spread spectrum	Spread-spectrum measurement technology
Microwave	Sea surface remote sensing with HF Radar	NRL	100	Determination that long-range radar sensing of sea conditions is accurate	Task aids in potential test problem by documenting scattering mechanisms
Electronic Warfare	Hi-Powered Jamming Systems	NAC	Unk	Testing Hi-Powered RF circuits --Safety	Test Hi-Power RF Wideband circuits
	Low-Frequency High-Voltage Communication Jammer	NAC	Unk	Hi-Power Test-Safety	Test of Hi-Power Low-Frequency circuits
Components	Application Investigation for VHSIC	NADC	93	Submicron Technology Testing-Needs BIT	End-to-end test of circuits with BIT in applications for Pulse Doppler Radar, ESM, & Acoustic Line Arrays.
	III-IV Compound Semiconductor M	NOSC	230	Test of new type semiconductor at very high frequency operations	BIT for ckts using new semiconductors at optical & imaging frequencies without degrading noise figure
	Advanced concepts in Hi Pwr	NRL	600	Not yet known	When new type mm-wave tubes
	Millimeter-wave Integrated Ckts	NRL	167	Test of integrated ckt solid state 10-,120-GHz components	Accurate 10-,120-GHz measurements of new planar transmission media components
	Monolithic FET Technology	NRL	170	Not yet known	Test of indium phosphide millimeter wave components.

TRANSMISSION ELECTROMAGNETIC TECHNOLOGY

6.1 Technology	Current Tasks	Activity	Funds $1000 units	Potential Test Problems	Test Technology Requirement
Components (Continued)	M/W Interactions with Semiconductor Devices	NRL	160	Not yet known	Investigates interaction of light with solid state microwave components for eventual control of same by light
	Near M/W Technology	NRL	142	Unknown-possible hi-resolution, all-weather semiconductor performance	Task investigates negative-resistance phenomena in semiconductors with non-parabolic conduction bands
	Secondary emissions from Oriented Films	NRL	106	Test of secondary emissions from cathodes in Power Microwave Tubes	Built-in monitoring of secondary emissions in Power Microwave Tubes
	Microwave Hi-Pulsed Power Combiner Research	NWC	75	Sensors for accurate Hi-Power microwave measurements	Build sensors into Hi-Power Microwave density devices.
Antennas	Antenna Systems Special	NRL	177	Spatial processing (Basically unknown until task complete)	Spatial processing. Unknown complete.
	Circular Adaptive Arrays	NRL	70	Unknown at this time	Adaptive arrays to suppress RF interference for aircraft
	H/F Array Control with Reactive Elements	NRL	116	Monitor Parasitic & active elements closely coupled	Qualitative end-to-end readiness test of new component arrays
	Microstrip Antennas	NWC	80	Unknown at this time	Unknown at this time.

TRANSMISSION ELECTROMAGNETIC TECHNOLOGY

6.2 Technology	Current Tasks	Activity	Funds $1000 units	Potential Test Problems	Test Technology Requirement
Radio Frequency	"Telecommunication Technology"	NRL	1,210	Unknown at this time	State-of-the-art HF Broadband communication components & architectures.
	"Low Probability of Intercept Radio Investigation	NWC	150	Remote sensor failures & test	Spread spectrum system test using remote sensors.
Microwave "M/W"	"Solid State Microwave System Support"	NAEC	70	State-of-the-art solid state M/W testing	Same
	"RF & M/W System Testability"	NAEC	70	None	Task directly supports future M/W avionics testing
	"USMC Tactical Surveillance"	NOSC	1400	Very lightweight BIT for Portable M/W Transceivers	RF, IR, siesmic detection transceivers
	"Advanced M/W Subsystems/ Techniques"	NRL	150	MMWave component & system testing	simulate clutter, & chaff for system readiness test.
	"RF & Microwave Test System"	NAEC	70	None	Task is in direct support of testing for future.
	"USMC Command Control Technology"	NOSC	1650	Unknown at this time.	State-of-art-test of M/W comm nets.
	"Church EYE"	NRL	650	Hi-Power M/W Test	Readiness testing of over-horizon Radar.

TRANSMISSION ELECTROMAGNETIC TECHNOLOGY

6.2 Technology	Current Tasks	Activity	Funds $1000 units	Potential Test Problems	Test Technology Requirement
Microwave	"Elevation Angle Estimation"	NRL	70	L-Band signal processing of Multi-Path Target Data	Design of built-in calibration signal system
	"Generic Monopulse Model"	NRL	300	Emulation of Radar	Task should support test by using model.
	"Maintenance-Free Radar"	NRL	240	None	Task is to aid test by improving reliability of radar by proper architecture design.
	"Modulation Techniques for Netter Radars"	NRL	250	Radar Net System Test	Same
	"MW/MM Wave Controlled Components"	NRL	1300	Broadband Hi-Pwr control testing.	MM wave radar system test
	"Radar Systems Research Studies"	NRL	160	Radar Clutter rejection system	Broad-based radar improvement concepts.
	"Hybrid Tactical Acquisition System"	NWC	100	Cluter rejection	RF/EO Sensor System Test
	"Radar Ship Profiler"	NWC	600	Hi-Resolution Radar Test	Auto Ship Radar Classification.
	"Multi-Sensor Ship Classification"	NWC	200	Unknown at this time.	Multi-sensor system test.
	"Automatic SAR Ship Classification"	NWC	300	Unknown at this time.	Synthetic Radar Aperture Test

TRANSMISSION ELECTROMAGNETIC TECHNOLOGY

6.2 Technology	Current Tasks	Activity	Funds $1000 units	Potential Test Problems	Test Technology Requirement
Electronic Warfare	"ESM Rcvr/Processor Availability"	NOSC	850	None	Task is design for testability, RM, etc., improvement program.
	"Dynamic EW Signal Processor"	NRL	100	Unknown at this time.	Test new EW architecture designs
	"Long Pulse Decoy"	NWC	190	Unknown at this time	Anti Radiation Missile Decoy Test
Components	"Development of Micro-Devices"	NAC		Unknown at this time.	Thick & thin film, SAW, Microwave IC's, Fine-Line Lithography
	"Developing 60 Watt IC's"	NAC		Unknown at this time	60-watt microwave IC's
	"100-MHz Tunable Band-pass Filters"	NAC filters		Unknown at this time	100-MHz Tunable Band pass
	"200-250 MHz Tunable Bandpass Network on a Chip"	NAC		Unknown at this time	See name
	"TIES Wideband Signal Distribution System"	NADC	254	Wideband Signal Test	Wideband signal distribution via freq. Div. Multiplex Bus
	"TIES Narrowband Signal Conversion Unit"	NADC	364	Narrowband digital signal processor	TIES architecture multifunction (AM, FM, SSB, Link 4, & Link 11) system readiness test
	"RF Communications Technology	NADC	460	New component testing	Hi Dynamic Range Electronic Tuner, Broadband, Surface Wave filters, multimode IF Amps.

TRANSMISSION ELECTROMAGNETIC TECHNOLOGY

6.2 Technology	Current Tasks	Activity	Funds $1000 units	Potential Test Problems	Test Technology Requirement
Components	"Microwave Tube Development"	NOSC	1430	Hi Power RF Tube Test	Part of Task is test development
	"MM Wave Device & Circuit"	NOSC	574	MM Wave IC's, & Travelling Wave Tubes	Same
	"MM Wave Communications"	NOSC	469	Q-Band component testing & BIT	Q-Band converters, solid state amps, & TWT's
	"X Band Solid State Modules"	NRL	730	BIT in solid state modules	Airborne solid state transmitters, T/R switches, Rcvrs, phase shifters, etc., all X Band
	"Broadband Cancellor Technology"	NRL	120	Broadband Test	Sidelobe cancellors in Broadband Radars
	"Cathodes for MM Wave Power Appl"	NRL	430	BIT in Power MM Wave ckts	Same
	"Hi Speed Signal Sorter"	NRL	213	LSI/MSI components	Programmable adaptive processor in exotic signal tracker
	"MW Devices tech for ECM"	NRL	560	Not known	MW devices performance improvement
	"MW Semiconductor Dev. & Circ."	NRL	120	Gallium Arsenide Transistors	Microwave solid state devices
	"MW Tubes for Radar Applications"	NRL	220	Hi-Power Magnetron tests	BIT in Magnetrons & associated components.
	"Solid State Components for ECM"	NRL	116	MW & MM Wave Testing	Test components near performance limits.
	"Ultra Fast Tunable MW Filter"	NRL	200	BIT in MW Components	Test Hi-Speed Tuning Ckts
Antennas	"Near Field Antenna Measurement"	NAEC	70	None	Aids Test Tech algorithm for boresight & radiation pattern

TRANSMISSION ELECTROMAGNETIC TECHNOLOGY

6.3 Technology	Current Tasks	Activity	Funds $1000 units	Potential Test Problems	Test Technology Requirement
Radio Frequency	"HF Improvement Program"	NOSC		Unknown	Intertask Force HF Comm link testing
	"AJ Techniques Adaptive Antennas Modems"	NRL	300	Unknown	Anti-Jam LOS Comm System Test
	"EM Source Elimination (ERASE)"	NWC	1600	Simulation of radiation patterns for test	System test of tracking/missile system to pinpoint & target radiation sources
Microwave	"Warning Rcvr MM Wave Modification"	NOSC		No built-in DFT	MM Wave Rcvr-post design mods for test
	"MW EW Rcvr Des"	NOSC		Post-Design Test Aids	MM EW Receiver Test
	"Area Sam Technology Multi-Mode Guidance"	NWC	700	Unknown	Missile guidance & control testing
	"MICRAD ASM Guidance"	NWC	1880	MW radiometric guidance system test	Passive sensor test with high sensitivity
Electronic Warfare	None				
Components	"ERASE) Electromagnetic Radiating Source Elimination"	NOSC		Unknown	Task is to develop components for use in pinpointing radiation sources
	"Coherent Cyclotron Radiation"	NRL	100	Measurement of hi pwr 1- to 10- mm-wavelength devices	Same
	"NAVSTAR GPS Tech Development"	NRL	4600	Monitor cesium time standards for proper operation	Same
	"Passive Components Broadband"	NRL	140	Unknown	Monitor operation of Hi & Lo Pwr MW passive devices
Antennas	None				

D, COMPUTER TECHNOLOGY

Computers are not a Navy stand-alone technology since they are, typically, part of a weapons system. There is, however, a growing emphasis on shipboard computers for management and administrative functions such as personnel and logistics. Also, with the advent of distributed processors and sophisticated software that replace electronic functions, computer applications are expanding. Thus, the role of the computer and software is becoming very important to systems testability.

5-7 YEARS

A period of upgraded hardware technology and increased software complexity will offer the opportunity to gain in systems-level testability. Taking advantage of this opportunity will require immediate action to encourage ongoing programs to consider testability in their designs.

7-10 YEARS

The Logistics system will begin to use computers more extensively. A data link between ATE and Logistics can reduce maintenance manpower by automating maintenance data reporting and replacement parts requests. This would be a valuable step towards the paperless ship.

Major systems integration through new computer applications offers possibilities to implement the Operational Readiness Monitoring System (ORMS).

Extensive application of distributed microprocessors creates a driving need to enhance subsystem testability through these microprocessors.

10-15 YEARS

Real-time high-frequency signal processors in new weapons systems will require dynamic test capabilities not available today. BIT may provide the only adequate test of these systems.

COMPUTER TECHNOLOGY

6.1 Technology	Current Tasks	Activity	Funds $1000 units	Potential Test Problems	Test Technology Requirement
Architecture	"Architecture Tuning of Signal Sorters"	NRL	57	Real time processing of radar signals	Real time dynamic tests
Software	"Development of Advanced Airborne Executive Program"	NADC	165	Self-test provisions	Advanced inflight self-test executive software

6.2 Technology	Current Tasks	Activity	Funds $1000 units	Potential Test Problems	Test Technology Requirement
Architecture	"Navy Logistics Distributed Terminal Processing"	NSRDC	250	None	Link logistics processors with ATE computers
	"Shipboard Material Control, Distribution & Storage"	NCSC	870	None	Same as above
	"Combat Direction System Processing"	NOSC	300	Integrate with ORMS	CDS/ORMS compatibility
	"Air Weapons Microproc. (microprocessor applications to airborne weapon systems)"	NWC	150	Increased weapons complexity	Testability software for micro-processors
Software	"Shipboard Logistics Data Processing System"	NSRDC	70	None	Tie in with ATE computer

6.3 Technology	Current Tasks	Activity	Funds $1000 units	Potential Test Problems	Test Technology Requirement
Architecture	"AN/USQ-20B Emulation"	NOSC	515	Newer technology computer utilizing existing software	Computer and interface testability

E, ELECTRO-OPTICS TECHNOLOGY

In the table, electro-optics (EO) technology development efforts are divided into six subtechnologies for analysis. These subtechnologies are:

Fiber Optics	Lasers
Infrared	Optical Devices
Ultraviolet	Television

Summary of impact on Test Technology:

5-7 YEARS

Some programs in electro-optics are being conducted to solve test problems in other areas. These efforts will require calibration technologies.

The complexity of the new technologies being introduced in this time frame necessitates a thorough testability analysis of each. It might be too late to impact design, but the Fleet's upcoming test problems might still be lessened. Only one program has written into its plan that consideration will be given to automatic calibration and test. Another program identifies fault-tolerant design as a goal.

Testability analysis tools are required to facilitate the review of maturing new designs.

7-10 YEARS

Lasers are going to present a formidable test problem in the future. It may be necessary to develop a BIT capability to determine operability without actually operating the laser. Lasers operating as radars and landing guidance system will require a test technology similar to that developed for radar systems.

The EO systems, IR through television, will use complex image processing and enhancement techniques. Devices such as optical integrated circuits will require a new automated test technology. Real time processing will exceed our current ATE capabilities.

Electro-optics will be employed in roles previously reserved for the human eye and far exceed human capabilities. Test technology will have to produce an assortment of simulators and sophisticated measurement tools, e.g., automated image analyzers, to match these systems.

Calibration technology development requirements will be driven by the new test technologies. For example the new Fluorescence Analyzer employing lasers and fiber optics will provide new calibration problems.

10-15 YEARS

More new technologies, such as acoustic optics, will be employed in EO systems. This technology will enable sonar to be converted into images. Thus test technology might have to address the problem of simulating the ocean bottom (clutter), hundreds of feet of seawater (sensitivity), and targets (resolution) to test these systems on shore.

Calibration will be a continually growing effort to stay abreast of these technologies.

ELECTRO-OPTICS TECHNOLOGY

6.1 Technology	Current Tasks	Activity	Funds $1000 units	Potential Test Problems	Test Technology Requirement
Fiber Optics (FO)	InfraRed Detectors	NOSC	80	Measurement of degradation	IR calibration and test equip.
	Fiber Optic Sonar System	NRL	981	low sensitivity & polarization	Unknown
	Clearday Ultralowloss Fiber Optics	NRL	200	long F.O. applications	Single end continuity tests
	Dev.F.O. techniques for	NRL	335	Calibration for new test applications	Test probe (new capability)
Lasers	Solid State Lasers for Hydrography	NADC	64	New Lasing frequencies	Narrowband test & calibration
	Rare Earth Vapor Phase Lasers	NADC	125	Metal must be vaporized	
		NRL	130		
	Chemical & Molecular Lasers	NRL	238	May require passive tests	
	Electrically Excited Lasers	NRL	155	Dangerous Electric Discharge	
	Explosive Lasers	NWC	88	High explosive blast required to test	
Infrared IR	Special Optical Sensor Mtrls & Dev.	NSWC	88	Possible new untestable technologies	Dev. testability technologies
Optical Devices	Acousto-Optics Navy Materials Supt.	NRL	315	Acoustic-to-Video Conversion	Acoustic Simulators, Sensitivity, etc.
	Image Processing	NRL	90	Complex new processors/ synthesizors	Testability
	Optical Diagnostics	NRL	85	Might benefit test technology	Calibration
	Optical Microcircuitry	NRL	65	Acousto-Optic & Electro-Optic processes	New Technology
	Optical Processing Techniques	NRL	200	Real time image processing	High-speed tests
	Visible, IR, E-O Devices	NWC	271	Developing broad optical technology	Good place to investigate test
Ultraviolet (U.V.)	Far U.V. Environment & Sensor Dev.	NRL	431	Ultraviolet imaging	U.V. image simulation, Calib.
	Satellite U.V. imaging sensor	NRL	544	Sensor may be applied to ground systems	Test, Calibration, & Alignment
Television	Image Processing (See Optical Devices)				

ELECTRO-OPTICS TECHNOLOGY

6.2 Technology	Current Tasks	Activity	Funds $1000 units	Potential Test Problems	Test Technology Requirement
Fiber Optics (FO)	FO Test Capability for ATE	NAEC	20	Calibrating FO subsystems	FO Calibration Technology
	FO Technology	NOSC	1320	Prepares FO for Fleet applications	Test is not ready FO Fleet support
	Optical Cables for Towed Arrays	NRL	120	Measuring degradation FO Cables	FO built-in-tests & sensitivity meas.
Lasers	Blue-Green Laser Development	NADC	75	Airborne survey device	Laser test, alignment, & calibration
		NRL	225		
	Electronic State Lasers	NRL	400	High power, electronically excited	Safe test capability & BIT
	Free-Electron Lasers	NRL	230	Electron Beam Excitation	Safe test capability & BIT
	Pulsed Chemical Laser Tech	NRL	2700	High power	Safe test capability & BIT
	Photo-initiated DF Laser	NRL	600	Requires uniform flow of lasing fluid	Safe test capability & BIT
	Adv Hypersonic wedge Nozzle Tech.	NRL	400	Laser that operates like a rocket motor	Field test only
	Laser Radar Technology	NRL	1168	New sensitivity and accuracy problems	Dev. new types of radar test equip.
	Expendable Laser Illuminator	NWC	295	Low cost, minimal support cost	Built-in test
Infrared (IR)	USMC Tactical Surveillance	NOSC	1400	Portable & highly sophisticated	BIT and Field alignment
	Clutter Rejection for IR Array	NRL	150	Increased complexity	BIT
	IR Focal Plane Array Sensors	NRL	175	3-5 micrometers sensitivity & complex system	Target simulator with clutter & BIT
	Strike Applications of FLIR	NWC	100	Attack aircraft avionics	BIT, simulator, alignment & sensitivity
	Multi-Sensor Ship Classification	NWC	200	Real time signal processing	Ship simulation, high speed tests, BIT
	Concealed-Origin Optical Locating System	NWC	150	Dual mode laser/IR systems	Complex simulators & alignment
	Laser-Augmented Air Rescue Sys	NWC	100	Dual mode laser/IR systems	Complex simulators & alignment
Optical Devices	Optical Hydrophone	NADC	120	complex sonobuoy system	Simulate or test in water?
	Electro-Optic Technology	NOSC	1550	New Optical Devices applications	Ongoing testability analysis & dev.
	EO Weaponry	NRL	431	New Optical Devices applications	Ongoing testability analysis & dev.
	Acoustic-Optical Tech. Adv.	NRL	160	New technology	Ongoing testability analysis & dev.
		NWC	330		
	Single-Mode Optical Tech.	NRL	1815	Micro Optic Integrated Circuitry	Revolutionary test concepts
Ultraviolet (UV)	USMC Command Control Tech.	NOSC	1650	UV communications link	UV signal source, measure & calibrate
Television	None				

ELECTRO-OPTICS TECHNOLOGY

6.3 Technology	Current Tasks	Activity	Funds $1000 units	Potential Test Problems	Test Technology Requirement
Fiber Optics (FO)	Bearing Performance Monitoring	DTNSRDC	400	Calibration may be unique	This is a test tech.application. calibration analysis required
	Avioptics	NOSC	1330	F.O. Multiplex Bus in aircraft	Portable F.O. Tester and BIT
	Unified Single-Fiber MT Prog.	NOSC	2050	Dev. F.O. connectors	Testability required
Lasers	Develop Ring Laser Gyros	NAC	Unknown	Rate Tables, Test significance	BIT, Test req. analysis
		NADC	2430		
		NWC	4177		
Infrared (IR)	Adv.IR Scanners & Display	NAC	Unknown	New Technology entering Fleet soon	Testability analysis
	IR Attack Weapon	NWC	647	Imaging IR missile	Testability analysis ATE IR Technology
Optical Devices	Image Processing	NAC	Unknown	Complex electronics & software	High speed testing
	Adv. Unmanned Search System	NOSC	680	Prog. is using auto cali. & test	Measure the success of this program
Ultraviolet	None				
Television	Digital Zoom TV	NAC	Unknown	TV difficult to automate tests	Resolution, sensitivity, shades of gray,etc.
	Area SAM Tech/Multimode	NWC	700	New sophisticated guidance system	BIT

F, ACOUSTIC TECHNOLOGY

Acoustic technology development within the Navy is mostly in the area of sonar. There is considerable work in acoustic-to-video translation, but these tasks were identified in the electro-optics technologies.

Summary of impact on Test Technology:

5-7 YEARS

An emphasis on active and passive towed or stand-alone sonar systems has created a definite requirement for built-in tests (BIT). A form of telemetry BIT would be particularly suited to the unmanned sonar systems.

Target simulation will be a problem with testing sonar ranging systems. These sonars will involve computers in complex real-time signal processing, which might press current ATE capabilities.

Acoustic communication and acoustic doppler will present some unique problems for laboratory type of tests. Methods of simulating water and distance need be developed.

7-10 YEARS

The test technologies for sonar must advance to provide the greater accuracy and sensitivity measurement capabilities for these future systems.

Unique materials will be employed as sonar transducers and sensors. Charge coupled devices will also be used to achieve high-resolution beamforming sonar. Methods for measuring acoustic beam quality and alignment will be required.

10-15 years

Test technologies will be required to match the effects of the following new technologies will have on sonar capabilities.

Analog Low-Pass Transversal Filters
Ferrofluid Liquid Dielectric Transducers
Optical Transducers
Ceramic Transducers

ACOUSTICS TECHNOLOGY

6.1 Technology	Current Tasks	Activity	Funds $1000 units	Potential Test Problems	Test Technology Requirement
	Low-Power Adv. Acoustic Signal Processor	NOSC	155	Analog low-pass transversal filters with monolithic Charge Coupled Devices	Matching test technologies and BIT for Array elements
	Advanced Transducer & Radiation Concepts	NRL	106	Ferrofluid Liquid Dielectric and optical transducer	"
	Transducer Application of New Ceramic Materials	NUSC	30	May result in unique sonar frequency	"

ACOUSTICS TECHNOLOGY

6.2 Technology	Current Tasks	Activity	Funds $1000 units	Potential Test Problems	Test Technology Requirement
	High-Definition Sonar Technology	NCSC	900	Complex system	BIT
	Evaluate CCDs for Hi Resolution Sonar Beam Forming	NCSC	100	CCDs	CCD Test Technology
	Transduction Sciences	NOSC	1050	Magnetostrictive and polymer materials for low-frequency sonar	New test stimulus
	USMC Tactical Surveillance	NOSC	1400	Portable seisimic/acoustic surveillance equipment	BIT and stimulus
	Large and Wide Aperture Array	NOSC	300	Investigates the limits of array technology	BIT
	Sonar Standards and Measurement Techniques	NRL	700	None	This is a Test Technology effort
	Advanced Autonomous Array	NUSC	230	Stand-alone sonar	Telemetry BIT
	Sensor Design for Undersea Surveillance	NUSC	100	High pressure	BIT at high pressures
	Parametric Sonar Echo Ranging Systems	NUSC	125	Sonar Ranging	Range stimulus
	Acoustic Transient/Intercept Development	NUSC	100	Sonar Bearing	Bearing accuracy

ACOUSTICS TECHNOLOGY

6.3 Technology	Current Tasks	Activity	Funds $1000 units	Potential Test Problems	Test Technology Requirement
	ASW Rapidly Deployable Surveillance System	NADC	1296	Test before deployment	BIT
	Shipborne Minehunting Sonar	NCSC	1500	Highly sensitive system	Sensitivity measurements
	Pressure/Acoustic/Magnetic Minesweeping System	NCSC	1199	Triple-mode high-power system	Performance effectiveness measurement and calibration
	Doppler/Pulse Sonar System	NCSC	1000	High resolution & audio doppler	Audio doppler test technology
	Adaptive Line Canceller & Enhancer	NOSC	1400	Complex Passive Sonar Sensor	Stimulus and sensitivity tests
	Advanced Unmanned Search System	NOSC	680	Long periods of operation without external test	BIT, telemetry and fault tolerance
	Acoustic Communication Sea Test	NOSC	1000	Unique communications devices	Translate radio test technologies to meet new requirements
	RAPLOC/WAA System	NUSC	7003	Wide-aperture-array range finding	Simulate acoustic ranges
	Submarine Active Detection Sonar	NUSC	3821	Sonar mounted on subs	BIT
	RAPLOC Low-Impact Dev. Program	NUSC	992	Passive acoustic localization	Target simulation and alignment
	Sonar Development for Adv P1	NUSC	2000	Towed array	BIT
	Advanced Surface Sonar Program	NUSC	3490	Computer-aided-ranging towed array	Target simulation, BIT

TECHNOLOGY ASSESSMENT DISTRIBUTION LIST
1 April 1981

Agrios, John
CORADCOM-DRDCO-TCS-M
Fort Monmouth, NJ 07703
AV 992-5230 CML 201/532-5230

Aguais, R. W.
General Dynamics/Electronics
P.O.Box 85106
San Diego, CA 92138

Ahlstrom, Edwin R.
Electronics Tech. & Devices Lab
Attn: DELET-D
Fort Monmouth, NJ 07703
AV 995-4059 CML 201/544-4059

Allen, Charles A., Code 2022
Naval Air Development Center
Warminster, PA 18974
AV 441-2380 CML 215/441-2380

Angulo, Steve, Code 3144
NESEC
P.O.Box 80337
San Diego, CA 92138
AV 957-3137 CML 225-3137

Andrews, Dan, Dr., Code 09
Naval Ocean Systems Center
San Diego, CA 92152
AV 933-7111 CML 714/225-7111

Baca, Albert B.
HQ AFLC/LOWCT
Wright Patterson AFB OH 45433
AV 787-7095 CML 513/257-7095

Baldwin, M. M. Code 18
Naval Ocean Systems Center
San Diego, CA 92152

Barbour, William D.
COMNAVSURFPAC, N4622
Coronado, CA 92118

Barry, E., Code 38310
Naval Air Rework Facility, NAS NI
San Diego, CA 92135
AV 951-5772 CML 714/437-5772

Bauer, John E., Code 92511
Naval Air Engineering Center
Ground Support Equipment Department
Lakehurst, NJ 08733
AV 624-2844

Bayles, Tom, Code 8302
Naval Ocean Systems Center
San Diego, CA 92152

Beatty, C. G., Code 06
Naval Ocean Systems Center
San Diego, CA 92152

Bednar, George, ELEX 48034
Naval Electronic Systems Command
Washington, D.C. 20360

Beiman, Henry
NAVWESA (ESA-822)
Washington, D.C. 20374
AV 288-3753 CML 202/433-3753

Bekken, Dean, Code 31A2
NESEC
San Diego, CA 92138

Benati, Michael A.
CORADCOM
ATTN: PM, ATSS
Fort Monmouth, NJ 07703
AV 992-2361 CML 201/532-2361

Bland, Bernard L., Jr., MAT 04123
Naval Material Command
Washington, D.C. 20360

Blevins, S., Code 331
Naval Air Rework Facility
NAS/NI
San Diego, CA 92135
AV 951-5631 CML 714/437-5631

Bolin, H. W., Jr.
WR-ALC/MAIC
Robins AFB GA 31098
AV 468-5061 CML 912/926-2457

Both, Robert J. (DRDEL-ILS)
U.S.Army Electronic Research
& Development command
2800 Power Mill Rd
Adelphi, MD 20783
AV 785-6600 CML 513/255-2613

Bowman, John A.
Naval Research Laboratory, Code 7424
Washington, D.C. 20375
AV 297-2061 CML 202/767-2061

Brown Don
ASD/AEGE
Wright Patterson AFB
OH 45433

Bryne, Richard O.
ASD/AEG
Wright Patterson AFB
OH 45433
AV 785-2996, CML 513/225-2996

Buckland, Joseph R.
Commander, Tobyhanna Army Depot
ATTN: SDSTO-MI-P
Tobyhanna, PA 18966
AV 247-9492 CML 894-8301 ext 7492

Bucsek, Gerald, Code 2022
Naval Air Development Center
Warminster, PA 18974
AV 441-2380, CML 215/441-2380

Burman, George, CDR, Code 4326
Commander in Chief
U. S. Pacific Fleet
Pearl Harbor, Hawaii

Callaghan, James M., LCDR
Commander
Operational Test and Evaluation Force
Naval Base
Norfolk, VA 23511

Campbell, George W., Code N411
Naval Training Equipment Center
Orlando, FL 32813

Cantor, Leonard H., Code 2022
Naval Air Development Center
Warminster, PA 18974

Cannon, Patrick J.
Naval Air Rework Facility
Alameda, CA 94501

Cauffman, James (ELEX-3041)
Naval Electronic Systems Command
Washington, D.C. 20360

Chase, Joe
ASD/AEGB
Wright Patterson AFB
OH 45433

Chasteen, Robert F.
United States Air Force
ASD/AEGL
Richmond, IND 47374

Chen, Robert S.
DCRL-OTS
11099 So. LaCinega Blvd.
Los Angeles, CA 90045

Cluer, Walter Steven, Code 384
Naval Air Rework Facility
San Diego, CA 92135
AV 951-5740, CML 714/437-5740

Coppola, Anthony
USAF/RADC
Griffiss AFB, NY 13441
AV 587-4726 CML 315/330-4726

Colvin, Brian, Code 61130
Naval Air Rework Facility
NAS North Island
San Diego, CA 92135
AV 951-6269 CML 714/437-6269

Conboy, Thomas W., CAPT USN
Naval Material Command, MAT 09E
Washington, D.C. 20360
AV 222-3653 CML 202/692-3653

Copeland, D. Patrick
US Army
Martinez, GA 30907

Cotnam, J. L.
Computer Resources Branch
Kelley AFB
Texas 78241
AV 945-6011, CML 512/925-3257

Cottrell, James E., Code U-23
Naval Surface Weapons Center
White Oak Laboratory
Silver Spring, MD 20910

Cowell, Samuel
MIRADCOM DRPMI-DPI
Redstone Arsenal, AL 35809
AV 746-4025, CML 205/876-4025

Cully, M. L., Code 3142
NESEC, P.O. Box 80337
San Diego, CA 92138
AV 957-3137, CML 714/225-3137

Craig, Curtis D., MISG-C Code L-98
Navy Segment-Tinker AFB
Oklahoma City, OK 73145
AV 735-3735, CML 405/734-3735

Davis, John O., Col, USAF
AFALD/SDN
Wright Patterson AFB
OH 45433
AV 785-5434 CML 513/255-5434

DeCarlo, Joanne, Code 460B
ELEX HQ
Washington, D.C. 20360

DeGennaro, Paul, Code 94333
Naval Air Rework Facility
San Diego, CA 92135
AV 951-5832 CML 714/437-5832

Delegado, Raul
NESEC, Code 313
P.O. Box 80337
San Diego, CA 92138
AV 957-4601 CML 714/225-4601

DeMattia, Henry J. (SEA-61R4)
Naval Sea Systems Command
Washington, D.C. 20362

Desilets, Don, Code 3654
Naval Underwater Systems Center
Newport, Rhode Island 02840

Dewey, John E.
SA-ALC/MMIMP
Kelley AFB, TX 78241
AV 945-3734 CML 512/925-3734

Devereaux, John F. (SEA-06C)
Naval Sea Systems Command
Washington, D.C. 20362

DiLugrezio, John F.
CERCOM
Fort Monmouth, NJ 07703

Dodson, Tom, Code 313
NESEC
P.O. Box 80337
San Diego, CA 92138
AV 957-3137 CML 714/225-3137

Dorman, Jack, Code 4111
Naval Underwater Systems Center
New London, CT 06320

Dubois, R. H., Code 08
Naval Ocean Systems Center
San Diego, CA 92152

Dunaway, Bob, Code MA
Metrology Engineering Center
1675 West Mission Blvd.
Pomona, CA 91766
CML 714/624-5111 X3020

Doubleday, Bruce K., MAT 045
Naval Material Command
Washington, D.C. 20360

Edmonds, Frank
Electronic Associates, Inc.
185 Monmouth Parkway
West Long Branch, NJ 07764

Eisenberger, Arthur
Lockheed Elec. Co.
1501 U.S. Hwy 22
Plainfield, NJ 07061

Elbinger, Walter H.
ASD/AEGM
Wright Patterson AFB
OH 45433
AV 785-2931 CML 513/255-2931

Ellis, John, CDR Code 0211
Naval Ocean Systems Center
San Diego, CA 92152

Ereckson, E., Code 825
Naval Ocean Systems Center
San Diego, CA 92152

Everett, Ivan W.
Naval Sea Sys. Cmd.
SEA-06C21
Washington, D.C 20362

Fernandez, Frank Code 32
NESEC
P.O. 80337
San Diego, CA 92138
AV 957-3137 CML 714/225-3137

Feeney, John, Code 2022
Naval Air Development Center
Warminster, PA 18974
AV 441-2380 CML 215/441-2380

Fletcher, Paul, Dr., Code 92
Naval Ocean Systems Center
San Diego, CA 92152

Frassmann, Franz A., Code 752
Naval Coastal Systems Center
Panama City, FL 32407
AV 436-4291 CML 904/234-4291

Fry, W. R.
Officer in Charge
GIDEP Operations Center
Corona, CA 91720

Galbraith, Grant B.
Commandant of the Marine Corps
(LMA-4)
Washington, D.C. 20380
AV 224-4658 CML 202/694-4658

Gamble, R., Code 9204
Naval Ocean Systems Center
San Diego, CA 92152

Gardiner, Kenneth D., Code 3654
Naval Underwater Systems Center
Newport, RI 02840
AV 948-3248

Gardner, Edson E., Jr.
USADARCOM/DRCMT
Alexandria, VA 22333

Gembarowski, Charles Jerry
ASD/AEGB
Wright Patterson AFB OH 45433
AV 785-6612 CML 513/225-6612

Giordano, Paul
Gidorano Associates, Inc.
295 East Shore Trail
Sparta, NJ 07871

Gollomp, Bernard P.
Bendix Test Systems Div.
Teterboro, NJ 07608

Goodman, David
DAVEX Engineering Co.
11568 Sorrento Valley Rd.
San Diego, CA 92121

Grimes, Rodney
USAF ASD/AEGB
Wright Patterson AFB
OH 45433
AV 785-6612 CML 513/225-6612

Gross, Paul, MAT 04T3
Chief of Naval Material
Washington, D.C. 20360

Grove, H. Mark
Assistant for Def. Sys. Comp. Res.
& Electronics (OUSDR&E/SS)
Washington, D.C. 20301
AV 225-0121 CML 202/695-0121

Hall, Don, Code 8254
Naval Ocean Systems Center
San Diego, CA 92152

Hallenbeck, M. E.
Staff, COMNAVAIRLANT/532B16
NAS Norfolk, VA 23511
Av 690-3881 CML 804/444-3881

Hardin, CAPT
NAVELEX, Code 510
Washington, D.C 20360
AV 222-8481 CML 202/692-8481

Harrison, John (SEA-05R)
Naval Sea Systems Command
Washington, D.C. 20362

Hayes, James E.
NAVELEXDETMECH
P.O. Box 2020
Mechanix, PA 17055

Hayes, Jerry, Technical Director, Code 50
Metrology Engineering Center
1675 West Mission Blvd.
Pomona, CA 91766
714/629-5111 X3014

Haynes, George H., Jr.
U. S. Navy, NARF, Code 61300
Pensacola, FL 32508
AV 922-2129, CML 904/452-2129

Heauner, Harry W.
COMNAVSURFPAC
NAS NI
San Diego, CA 92135

Henscheid, Robert H., LtCol, USAF
Aeronautical Systems Div., ASD/AEGB
Wright Patterson AFB OH 45433
AV 785-6612 CML 513/255-6612

Herold, Lance
OASN (MRA&L) Electronics Programs
Washington, D.C. 20360
AV 222-3250 CML 202/692-3250

Hnatczuk, Wsewolod
TARADCOM (DRDTA-RGD)
28251 Van Dyke Avenue
Warren, MI 48090
AV 273-2160 CML 313/573-2160

Holland, C. E., Jr., Code 9203
Naval Ocean Systems Center
San Diego, CA 92152

Hollman, Nick, Code 312
NESEC
P.O. Box 80337
San Diego, CA 92138
AV 957-3256 CML 714/225-3256

Holmes, Stacy V., ELEX 310
Naval Electronic Systems Command
Washington, D.C. 20360

Holmes, Woodrow C. Jr.
HQ, CORADCOM(ATTN DRDCO-PPA-SA)
Fort Monmouth, NJ 07703
AV 995-2831 CML 201/544-2831

Holub, Paul H.
TMDS Division
Fort Monmouth, NJ 07703

Hoote, James, Code 824
Fleet Analysis Center
Naval Weapons Center, Corona Annex
Corona, CA 91720

Horvitz, Sam, Code 4111
Naval Underwater Systems Center
New London, CT 06320

Hornedo, Mike
NESEC, Code 03
P.O. Box 80337
San Diego, CA 92138
AV 957-4302 CML 225-4302

Huffnagle, Norman P.
Boeing
Wichita, KS 67210

Hunt, John W.
HQ AFLC/LOWCT
Wright Patterson AFB
OH 45433
AV 787-3504 CML 513/257-7095

Jacobs, Steven Frederick
U. S. Army Central TMDE Activity
DRXCT-TP
Lexington, KY 40503
AV 745-4270 CML 606/293-4270

Jacques, R. A., MAT044B
Naval Material Command
Washington, D.C. 20360

Jepsen, Leslie L.
SAMSO/AQT
P.O. Box 92960 World Way Postal Ctr
Los Angeles, CA 90009
AV 833-1182 CML 213/643-1182

Johnson, Gene, SEA-06C12
Naval Sea Systems Command
Washington, D.C. 20362

Johnson, Gilbert F.
California Microwave
990 Almanor Ave.
Sunnyvale, CA 94086

Johnson, Joseph
SA-ALC/MMIMP
Kelly AFB, TX 78241
AV 945-3734 CML 512/925-3734

Johnson, Kenneth
DRSAR-MAL
U.S. Army Armament Material Readiness Command
Rock Island, IL 61299
AV 793-4695 CML 309/794-4695

Johnston, James H., Code 3644
Naval Underwater Systems Ctr
Newport, RI 02840
AV 948-3002 CML 401/841-3002

Jones, J., Col
US Army Material Dev. & Readiness Cmd
ATTN: DRCDE-DG
5001 Eisenhower Avenue
Alexandria, VA 22333

Kamper, Robert A.
National Bureau of Standards
Boulder, CO 80303
CML 303/499-1000 X3535

Kammerer, John, Code 8254
Naval Ocean Systems Center
San Diego, CA 92152
AV 933-6564

Kelly, Joseph
Naval Air Station, NALC 2311B
Patuxent River, MD 20670
AV 356-4696 CML 301/863-4696

K iner, William L., Code F105
Naval Surface Weapons Center
Dahlgren Laboratory
Dahlgren, VA 22448
AV 249-8586 CML 703/663-8586

King, Don, Code 7465
COMNAVAIRPAC
San Diego, CA 92135
AV 951-6247 CML 714/437-6247

Konomos, George
ASD/AEGB
Wright-Patterson AFB OH 45433
AV 785-5744 CML 513/255-6612

Kraft, Robert, Code 954
Naval Avionics Center
6000 E. 21st Street
Indianapolis, IN 46218
AV 724-3877 CML 317/353-3877

Kraper, Bill
AAI Corp.
P.O. Box 6767
Baltimore, MD 21204

Kvenvold, Daniel J.
AFLC/LOEC
Wright Patterson AFB OH 45433
AV 878-2925 CML 513/257-2925

Lake, Wilbert
Department of the Army
DRSTS-MEC(2)
St. Louis, MO 63120
AV 693-1351 CML 314/263-1351

Lamb, John P., CDR USN
COMOPTEVFOR
Norfolk, VA 23511
AV 690-5187 CML 804/444-5187

Lay, Maynard
Aerospace Guidance & Metrology Center/MLP
Newark AFS OH 43055
AV 580-7788 CML 614/522-7788

Lederer, Paul S., Div 722
National Bureau of Standards
Washington, D.C. 20234
CML 301/921-3821

Lee, Leland W.
USA MIRADCOM
Redstone Arsenal, AL 35809
Attn: DRDMI-EAA
AV 746-5276 CML 205/876-5276

Leonard, Dan, Code 8105
Naval Ocean Systems Center
San Diego, CA 92152

Leonard, Vernon, Code 921
Naval Ocean Systems Center
San Diego, CA 92152
AV 933-6173

Lessmann, Robert
OO-AMA, MACTD
Hill AFB, UT 84056
AV 458-2698 CML 801/777-2326

Levitan, Lee, Dr.
Honeywell, MS MN17-2307
2600 Ridgeway Parkway
Mineapolis, MN 55413

Lindberg, O., Code 925
Naval Ocean Systems Center
San Diego, CA 92152

Line, G. E.
ASD/AEGM
Wright Patterson AFB, OH 45433
AV 785-2831 CML 513/255-2831

Liguori, Fred, Code 9251
Naval Air Engineering Center
Ground Support Equipment Dept.
Lakehurst, NJ 08733

Little, John, Code 1145
Pacific Missile Test Center
Point Magu, CA 93042
AV 351-7930 CML 805/982-7930

Long, Floyd D.
HQ ASD/AEGB
Wright Patterson AFB OH 45433
AV 785-6612 CML 513/255-6612

Lovell, Ray W.
Emerson Electronic Co.
6151 W. Century Blvd., Suite 508
Tishman Airport Center 1
Los Angeles, CA 90045

Lueking, Fran, AIR 360A
Naval Air Systems Command
Washington, D.C. 20361

MacMurray, Arthur C., Code 921
Naval Ocean Systems Center
San Diego, CA 92152
AV 933-6173

Madaris, William, CDR, ELEX 480
Naval Electronic Systems Command
Washington, D.C. 20360

Marloff, Muriel
HQ US Army Command & Electronics
Matl Readiness Command-DRSEL-PT-CP-RP
Ft Monmouth, NJ 07703
AV 992-5504 CML 201/532-5504

Maynard, E. D., Code 19
Naval Ocean Systems Center
San Diego, CA 92152

Mau, Peter, Code 824
Fleet Analysis Center
Corona, CA 91720

Maudlin, L., Code 91
Naval Ocean Systems Center
San Diego, CA 92152

McGavern, Robert
ASD/AEGE
Wright Patterson AFB OH 45433

McGee, Richard
Naval Avionics Center
Indianapolis, IN 46218

McGinnis, Frank
sperry Corp.
Sperry Div. HQ
Marcus Avenue-Mail Stop 2T104
Great Neck, NY 11020

McGrath, H. A., CAPT USN
NAVELEX Code 05
Washington, D.C. 20360
AV 222-8480 CML 202/692-8480

McWhirter, William R., Code 2731
David W. Taylor Naval Ship R&D Center
Annapolis, MD 21402

Meister, D., Code 311
Naval Personnel Research and
Development Center
San Diego, CA 92152

Merrow, C. M., Code 16
Naval Ocean Systems Center
San Diego, CA 92152

Micka, Frank
ASD/ENEG
Wright Patterson AFB OH 45433
AV 785-3210 CML 513/255-3210

Miller, Richard G., PhD
Science Applications, Inc.
7946 Ivanhoe Ave.
LaJolla, CA 92058
CML 714/454-3811

Mitchel, W. P., Code 07
Naval Ocean Systems Center
San Diego, CA 92152

Moore, Winston, Jr.
ANSER/AFRDPDX
Arlington, VA

Moberg, Victor, Code 331
Naval Air Rework Facility
North Island
San Diego, CA 92135

(CODE 427)
Office of Naval Research
800 North Quincy Street
Arlington, VA 22217

Monroe, Robert, Code 824
Fleet Analysis Center
Corona Annex
Corona, CA 91720
AV 933-5228

Mordecai, Lionel S., Code 061
Naval Air Rework Facility
North Island
San Diego, CA 92135
AV 951-6991

Mroz, E. A., ELEX 480
Naval Electronic Systems Command
Washington, D.C. 20360

Musa, Sam, Dr.
OUSDRE-Staff Assistant
Electronic Warfare & Target
Acquisition, Rm 3D1079, Pentagon
Washington, D.C. 20234

Myles, Michael D., (AIR-55224)
Naval Air Systems Command
Washington, D.C. 20361

Nadeau, Bob
Cerberonics
5600 Colombia Pike
Falls Church, VA 22041

Neatherlin, Robert
Commander, CORADCOM (DRDCO-TR)
Ft. Monmouth, NJ 07703
AV 992-4365 CML 201/532-4365

Neubauer, Roy E. Code 382
Naval Air Rework Facility
San Diego, CA 92135
AV 951-6878 CML 714/437-7631

Nelson, Ed, Code 3683
Naval Weapons Center
China Lake, CA 93555
AV 437-2103 CML 714/939-2103

Neumann, George W., MAT-04TD
Chief of Naval Material
Department of the Navy
Washington, D.C. 20360
AV 222-2035 CML 202/692-2035

Newman, D. P., Code 93
Naval Ocean Systems Center
San Diego, CA 92152

Nichols, Rodger, CDR, (Code 250)
Office of Naval Research
800 North Quincy Street
Arlington, VA 22217

Nunn, M. E., Code 921
Naval Ocean Systems Center
San Diego, CA 92152

O'Brian, V. T., AIR 41713B
Naval Air Systems Command
Department of the Navy
Washington, D.C. 20361
AV 222-2226

Oldham, William R.
HQ DARCOM (DRCRE-IA)
Alexandria, VA 22333
AV 284-9763 CML 202/274-9763

Overmier, C. S., Code 331
Naval Air Rework Facility
NAS NI
San Diego, CA 92135
AV 951-5631 CML 714/437-5631

Pakett, Allan G., Code 38201
Naval Air Rework Facility
NAS NI
San Diego, CA 92135
AV 951-5740 CML 714/437-6878

Parcell, Kenneth, CDR
COMSUBLANT (N221)
Norfolk, VA 23511
AV 690-6557 CML 804/444-6557

Parker, S., Dr.
Naval Postgraduate School
Monterey, CA

Patterson, R. G., CDR
COMFIT(MAINT) Code 70
NAS Miramar
San Diego, CA 92145

Pearson, L. T.
CORADCOM, ILS
Ft. Monmouth, NJ 07703

Peterson, Elmer L.
HQUSAF/RDPXM
Pentagon
Washington, D.C. 20330
AV 227-3040 CML 202/697-3040

Peterson, Reeve, Code 925
Naval Ocean Systems Center
San Diego, CA 92152

Plait, Alan O.
ManTech of NJ
2341 Jefferson Davis Hwy
Arlington, VA 22202
CML 703/979-0733

Plasterer, Charles S.
Commander, US Army Depot System Command
ATTN: DRSDS-EI
Chamersburg, PA 17101
AV 242-6321 CML 717/263-6321

Poland, Marc M., LCDR, Code 8254
Naval Ocean Systems Center
San Diego, CA 92152

(AIR-340E)
Naval Air Systems Command
Washington, D.C. 20361

Posakony, Paul R.
NSWSES, Code 5320
Pt. Hueneme, CA 93043
AV 360-5807 CML 805/982-5807

Powell, B. A., Code 05
Naval Ocean Systems Center
San Diego, CA 92152

Powell, T. R., Code 46
Naval Ocean Systems Center
San Diego, CA 92152

Prat, Al
General Dynamics/Electronics
P.O. Box 85106
San Diego, CA 92138
CML 714/692-7608

Price, Anton J., CAPT USAF
HQ TAC/LGMA
Langley AFB, VA 23665
AV 432-4418 CML 804/764-4466

Puglisi, Fredrick G.
ATE Marketing Manager
Grumman Aerospace Corp.
Bethpage, NY 11714

Putnam, Russell H.
Logistics Div., Code 1870
Comp., Math., & Log. Dept.
Naval Ship R&D Center, Carderock
Bethesda, MD 20084
AV 287-1367

Quesnell, Harris, Code 8254
Naval Ocean Systems Center
San Diego, CA 92152
AV 933-6227

Quinn, Charles A., Code 61240
Naval Air Rework Facility
NAS NI
San Diego, CA 92135
AV 951-7312 CML 714/437-7312

Re, Joseph, CDR, (OP-433T)
Chief of Naval Operations
Pentagon
Washington, D.C. 20350

Rabin, Herbert
Deputy Assistant Secretary of
the Navy (Research, Applied &
Space Technology)
Washington, D.C. 20350

Rast, Howard, Dr., Code 922
Naval Ocean Systems Center
San Diego, CA 92152

Rees, Gayle H., DRXCT-TP
U.S. Army Central TMDE Activity
Lexington, KY 40511
AV 745-4270 CML 606/293-4270

Richardson, J. D., CAPT USN
NAVELEX, Code 000
P.O. Box 80337
San Diego, CA 92138
Av 957-4366 CML 714/225-4366

Rhode, James B., Code 8344
Naval Ocean Systems Center
San Diego, CA 92152

Robing, Steve, SEA-06C1
Naval Sea Systems Command
Department of the Navy
Washington, D.C. 20362

Rockwell, Dale, Code MA
Naval Plant Representative Office
Metrology Engineering Center
1675 West Mission Blvd.
Pomona, CA 91766 CML 714/629-5111 X3662

Rockett, Arthur
Naval Avionics Center
Indianapolis, IND 46218

Rundel, Peter
Adv. Tech. Inc.
7923 Jones Branch Dr.
McClean, VA 22102

Sacane, Richard
DRDCO-TCS-MI/TMDS Div.
Centacs
Ft. Monmouth, NJ 07703
AV 992-5608 CML 201/532-5608

Saporito, James
RBRT/RADC
Griffiss AFB, NY 13441
AV 587-4205 CML 315/330-4205

Scherber, Floyd
Honeywell Inc., MM172303
2600 Ridgeway Parkway
Minneapolis, Minn 55413

Schissel, Art
Naval Air Rework Facility
Alameda, CA

Seger, James K.
Lockheed CA Co.
Dept 6476
Bldg 170, Plant 81
Burbank, CA 91520

Seiler, Michael R.
COMNAVAIRFORPAC
Code 742A, NAS NI
San Diego, CA 92135
AV 951-5740 CML 714/437-5740

Sepp, Oscar
ASD-AEG
Wright Patterson AFB, OH 45433
AV 785-2996 CML 513/255-2996

Seward, T., LCDR, Code NFM2
Commander in Chief
U. S. Atlantic Fleet
Norfolk, VA 23511

Shearer, R. T., Code 17
Naval Ocean Systems Center
San Diego, CA 92152

Shepard, Richard, Code 38111
Naval Air Rework Facility
NAS/NI
San Diego, CA 92135
AV 951-5740 CML 714/437-5740

Sherman, Roger A., CAPT USMC
CMC, Code LMA-4
HQMC
Washington, D.C. 20380
AV 224-2039 CML 202/694-2039

Siedlecki, Joseph, MAT 04T2
Chief of Naval Material
Washington, D.C. 20360
AV 222-2035 CML 202/692-2035

Simer, Harry, Code 31B
NAVELEX
P.O. Box 80337
San Diego, CA 92138

Simon, James W.
Deputy Commander Operational Test
& Evaluation Force, Pacific
NAS/NI
San Diego, CA 92135
AV 951-5624 CML 714/437-5624

Simonson, Boyd L., Code 8254
Naval Ocean Systems Center
San Diego, CA 92152

Slowik, William , Code 2022
Naval Air Development Center
Warminster, PA 18974
AV 441-2380, CML 215/441-2380

Smith, C. O., NESO Code 383
NARF/NAS NI
San Diego, CA 92135
AV 951-7631 CML 714/437-7631

Smith, G. B. III
SEA 05L1C2 (PATAO)
WNY Bldg 200 3rd Floor
Washington, D.C. 20362

Smith, Howard, Code 5320
Naval Ship Systems Engineering Station
Port Hueneme, CA 93042
AV 360-5807 CML 805/982-5807

Smith, James A.
Naval Weapons Engineering Support Activity
ESA 822
Washington, D.C. 20374
AV 288-3753 CML 714/433-3753

Smith, Ray
Sperry
1335 Hotel Circle South
Suite 205
San Diego, CA 92108

Sollman, Larry C., Code 70522
Naval Weapons Support Center
Crane, IND 47522
AV 482-1833 CML 812/854-1833

Sponaugle, Betty A., MAT 04TA
Naval Material Command HQ
Washington, D.C. 20360

Stefursky, Joseph
Commander, Tobyhanna Army Depot
SDSTO-MI-A
Tobyhanna, PA 18466
AV 247-9336 CML 717/894-8031

Stermer, Robert L., Jr., Code MIS 470
NASA Langley Research Center
Hampton, VA 23665
CML 804/827-3535

Stewart, Daryl, Code 5321
Naval Ship Weapon Systems Engineering Station
Pt. Hueneme, CA 93043
AV 360-5807

Strayhorn, Charles, ELEX-48032
Naval Electronic Systems Command
Department of the Navy
Washington, D.C. 20360
AV 222-7524

Stoud, Edward A.
ATE Systems Program Manager
Grumman Aerospace Corp
Bethpage, NY 11714

Stout, Jack E.
ASD/ENGEM
Wright Patterson AFB OH 45433
AV 785-2847 CML 513/255-2847

Swift, Dale
Naval Air Rework Facility
Alameda, CA

Telfer, K., Code 331
Naval Air Rework Facility
NAS/NI
San Diego, CA 92135
AV 951-5631 CML 714/437-5631

Tenefrancia, A. J., (MAT-04T)
Chief of Naval Material
Washington, D.C. 20360
AV 222-2035 CML 202/692-2035

Thalman, Robert H.
MAN TECH
NAVMAT Liaison ASD/AEGB
Wright Patterson AFB, OH 45433
AV 785-6612 CML 513/255-6612

Tieche, Robert V.
ASD/YPEC
Wright Patterson AFB OH 45433
AV 785-3848 CML 513/255-3848

Tinley, John
Bldg 111, MS12
Hughes Aircraft Co.
P.O. Box 90515
Los Angeles, CA 90009

Trinkle, John W. NESO 38301
Naval Air Rework Facility
NAS NI
San Diego, CA 92135
AV 951-6878 CML 714/437-6878

Trotter, J. L. Code 331
Naval Air Rework Facility
NAS NI
San Diego, CA 92135
AV 951-5631 CML 714/437-5631

Tuszynski, Al, Dr.
Univ. of Minnesota/EE Dept.
Minneapolis, MINN 55455

Usrey, Philip
HQ AFLC (LOWCT)
Wright Patterson AFB OH 45433
AV 787-3504 CML513/257-3504

Vares, Mabel, Code 921
Naval Ocean Systems Center
San Diego, CA 92152
AV 933-6173 CML 714/225-6173

Vickroy, J. W.
Hughes Aircraft Co.
Bldg E51, MSA 281
Culver City, CA 90230

Vogt, Jack L.
Project Manager for PMTE
Office of Measurement Services
U.S. National Bureau of Standards
Washington, D.C. 20234
CML 301/921-2805

Walker, J. Clark
Air Force Systems Command
AFSC/LGY
Andrews Air Force Base, MD 20334

Ward, C. L., Code 924
Naval Ocean Systems Center
San Diego, CA 92152

Watson, W. H., Dr., Code 9203
Naval Ocean Systems Center
San Diego, CA 92152

Weider, H. Code 922
Naval Ocean Systems Center
San Diego, CA 92152

Wheeloc[illegible], Charles M.
ASD/AEGB
Wright Patterson AFB, OH 45433
AV 785-6612 CML 513/255-6612

Whitesel, Henry K., Code 2732
David W. Taylor Naval Ship R&D Center
Annapolis, MD 21402
AV 281-2163 CML 301/267-2163

Wilson, Robert E.
U.S. Army TMDE Activity, DRXCT-TS
Lexington, KY 40511
AV 745-3857 CML 606/293-3857

Wingenter, Ronald C.
SA/ALC-MATTA
Kelly AFB, Texas 78241
AV 945-4374 CML 512/925-4374

Winkler, Dean
Naval Weapons Support Center
Crane, IND 47522

Winter, Don L., Code 3622
Naval Weapons Center
China Lake, CA 93555
AV 245-3361 CML 714/939-3361

Wolanski, Eugene W.
ASD/AEGE
Wright Patterson AFB, OH 45433

Wontorsky, Orest, Code 2022
Naval Air Development Center
Warminster, PA 18974
AV 441-2380 CML 215/441-2380

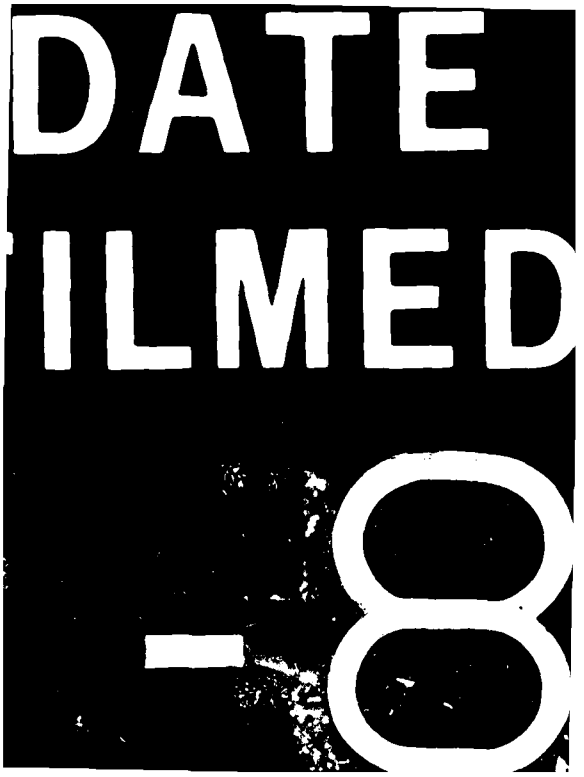
Writer, Philip L., Code 921
Naval Ocean Systems Center
San Diego, CA 92152

Wyatt, John, ELEX 5045
Naval Electronic Systems Command
Washington, D.C. 20360

Yaroma, John, SEA 62C2
Naval Sea Systems Command
Washington, D.C. 20362
AV 222-1425 CML 202/692-1425

Zelenka, Roy S.
DRDCO-TCS-MS
Ft. Monmouth, NJ 07703
AV 992-5608 CML 201/5332-5608

Zubkoff, M. J., Code 187
Naval Ship R&D Center
Annapolis, MD 21402


DATE
ILMED
-8